IRON ORE STATISTICS FOR 1891 ON PAGE 5.

THE IRON TRADE REVIEW

VOLUME XXIV. CLEVELAND, O., DECEMBER 10, 1891. NUMBER 50.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS
IS PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
27, 29 *and* 31 *Vincent Street, Cleveland, Ohio.*

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., DECEMBER 10, 1891.

THE WEEK IN IRON CIRCLES.

General Features.

So quietly that attention has scarcely been drawn to the fact, the railroads have been giving out their orders until, within the past two weeks, contracts for upwards of 200,000 tons of steel rails and 25,000 freight cars have been entered into. This, with the distinctly better tone in the money market, noted by all the leading financial papers, brings the country down to the end of the year with every prospect of a change for the better soon after the opening of the new year. Thus, our Detroit correspondent states that there has been a decidedly increased business in the general iron trade, during the past week, but no change whatever in prices. The fact that widespread car famine exists has impressed itself upon buyers, who are straining in every possible way to hasten deliveries of pig iron, and this particularly from the South, where the railroads seem to have even fewer cars for service than in the North. While a number of large orders for cars have been placed, it will be impossible for the comparatively small production of the next thirty or sixty days to have any great effect in relieving the situation. The car orders particularly have caused correspondingly increased purchasing of material for the early months of next year, large blocks of Lake Superior charcoal iron have been bought, and a number of good-sized deals are in prospect, and January 1st should show a decided decrease in stocks on hand unsold. Southern foundry and forge have also been freely bought, and nothing but the enormous stocks on hand and the present large rate of production could check an advance in prices The general situation is certainly much more encouraging, and even the long-delayed advance must now be closer at hand. The Chicago market has shown but little of interest during the past week, the bulk of business going has been for small lots for short deliveries, with the exception of here and there a good-sized sale. This is in accordance with usual conditions at this season of the year, and is not surprising. As to price, both Northern and Southern furnaces show a disposition to make concessions for desirable business; this is brought about by the accumulating stocks in both districts. Business in all metal lines continues on a healthy basis; the trade in general is in a far better condition than was the case twelve months ago. Manufacturers and consumers have retrenched with the result that to-day their liabilities are much smaller than usual, and they are in good condition to handle large expansion of business when the time comes. The Cincinnati market at the beginning of the week did not look very encouraging, but during the latter part considerable selling was done, and some of the existing indications are rather more cheerful. There is no improvement in prices, but several large transactions that have been closed, show that buyers are ready to anticipate their wants when concessions are offered. Buyers of steel billets have been trying the market, and in some cases have succeeded in finding sellers for six months' deliveries, at present quotations, but most producers refuse to sell so far ahead. Describing the Louisville iron market is simply a review of the preceding week. Trading is light and runs mostly in small quantities with an occasional order for as much as 500 or 1,000 tons. There are reports of a slight weakening on the part of large producers, who display considerable anxiety for orders for deliveries far into the future, and in some instances concessions are reported to have been made. Contracts have been entered into for deliveries through the entire of next year, but these may be regarded as exceptions and not the rule now. There are occasional requests on the part of some of the trade to hold up on deliveries, but in most cases the Southern furnaces find it exceedingly difficult to keep up on shipments by reason of the great shortage in supply of cars; in this particular it is said that in one district alone the shortage is about 3,000. Great efforts are being made to relieve this state of affairs, and according to promise the situation will be greatly improved by the first of the year. Some few large orders have been placed at Buffalo, deliveries being divided about equally between immediate shipment and distribution over the first six months of 1892. The feeling among buyers is still conservative but is more hopeful than during the past few weeks. The market at St. Louis cannot reasonably be considered dull, at the same time there is only the usual run of buying for this season of the year. The car works have nearly covered their contracts for several months to come, but more business from the railroads is in sight, and heavy buying will naturally follow. The demand for Southern irons in small lots is good. A number of sales of Lake Superior iron are reported at exceedingly low figures, and consumers of this class of material are stocking up. Considerable inquiry for Ohio irons is noticed. The outlook is encouraging, and the volume of business makes up the deficiency.

The Local Situation.

Now that the shipping season has finally come to an end, there is little more for the oremen to do but to take a vacation, which from all appearances may well last into a late Spring. Of the six and a-half millions tons of ore and over, handled this year through the various Cleveland sales agents, there is hardly more than 50,000 or 60,000 tons left unsold, distributed along the entire chain of Lake Erie ports. A portion of this is high-grade ore, held at a figure which the furnacemen do not see their way clear to give, and partly consists of small and broken lots, unsalable for that reason, so that practically and as far as all the purposes of trade are concerned, the entire product of 1891 may be said to be sold.

Iron Ore.

The ore interests are not going to take any hasty step this Winter, and from all appearances there is no movement on foot to increase this year's product, unless there should be an early demand of such strong urgency as fully to warrant a material widening of the ore market. The producers mean to be conservative, both as to prices and sales, and while, of course, they must necessarily take into account the condition of the trade at large as well as their forwarding facilities, they will ask fully half a dollar, and possibly more, on top of '91 prices.

Pig Iron.

The pig iron business is so thoroughly demoralized that some of the furnacemen take comfort from the paucity of the market in that, as they reason, it cannot get any worse, whereas recent developments have shown that when the bottom drops out of the market, what little is left of the market is likely to go the way of the bottom. The furnace trade is really in no position to find fault with the consumers when by holding off the consumer, as has been the case all this Winter, is enabled continually to cheapen his purchases. Some furnaces are running along so as to realize sufficient cash to meet their ore accounts, while others, not actuated by necessity, simply desire to keep in the market and retain their custom, even at a palpable loss. There are some, however, who take a more hopeful view of the situation by citing the beneficial influences to be exerted upon the market by the recent very large orders placed by the railways, both for new equipment and for replacement, but as in the very nature of the case it will take from 60 to 90 days before the results of these purchases may be made patent in any practical way, it is no less clear that the benefit, if benefit there is to come, is not to be expected for a considerable time. At present the price of pig metal is manifestly and unprecedentedly low, and if the trade at large does not take up all the stocks it is simply from the notion that iron will be lower yet.

OUR IRON ORE FIGURES.

On page 5 of this issue we present our customary annual exhibit of the movement of Lake Superior ore, especially with reference to production, distribution at Lake Erie ports, and the amount remaining on dock at the close of navigation. The figures, as usual, are derived at first hands, from official sources, and can be implicitly relied on. For courtesies uniformly extended on the part of railroad and customs officials we are, indeed, grateful. Comments on the data set forth will be found in connection with our figures and need not be repeated here. The year 1891 has been an exceptional one in many respects but its outcome has from the first been easily predicted and its unfavorable features have, therefore, been to the large extent discounted.

THE BEST TEST OF BUSINESS PROSPERITY.

The publication of the year's receipts of iron ore at the Lake Erie ports will doubtless re-open the question whether, after all, the diversion of much of this traffic from Cleveland to other distributing points is so great a detriment as at first might appear. Chicago, too, has suffered the same experience, in the diversion of an enormous grain-carrying trade from its elevators to those at the extreme head and foot of the great Lake System. As indicative of this revolution, it is stated that the trade of West Superior alone has grown from practically zero four years since to over $50,000,000 per annum now. While this represents in figures an immense loss to Chicago, it is more than discounted by gains in other directions, which are thus indicated by the *Iron Age:*

Never before has more activity been displayed in building up the manufacturing interests of the city and the environs than in this year of grace. Subdivisions without number have been opened on the outskirts of the city, with from one to a dozen manufacturing enterprises forming the foundation of each new settlement. Every railroad running into the city and the several belt lines connecting them are being built up at a remarkable rate with new manufacturing towns, some of which are of ambitious pretentions. Of the new manufacturing companies chartered under State laws, the average for Chicago alone is about four a day. This shows how the movement is growing. Real estate men estimate the increase in the population of the city at from 10,000 to 20,000 per month, caused largely by the removals of workmen and their families from other localities. Greater attention than ever before is now being given to the development of local traffic by these lines, as railroad managers see the advantage to be gained in this way as compared with the uncertain returns from through freight.

It is not unlikely that Cleveland is now undergoing a similar revolution; certainly many well-known facts go to show it; and, after all, is not the solid growth of our manufacturing interests of vastly more importance than an annual array of figures which indicate rather the movement of business in transit than the creation of business within our borders?

RECENT MOVEMENTS OF TRADE COMBINES.

Some interesting movements have recently taken place among the "combines" in the iron and steel trade that are worthy of notice. First we note the fact that the Eastern cast-iron pipe manufacturers met at Philadelphia last week and took the preliminary steps toward forming an association. The wrought iron people have been organized for several years, but the cast iron makers never got together. A number of mills are located in the Lehigh Valley and around Philadelphia. The bulk of the cast iron foundries are in the South, and the Northern manufacturers find it desirable to come to some understanding in order to meet the Southern competition.

Next, we chronicle the fact that there are prospects of a combination of the saw manufacturers of the United States, though the particulars are not at present forthcoming. It is denied, however, that a "trust" is contemplated.

A similar report has been in circulation regarding a pool of the manufacturers of iron and steel roofing, but that such a combination has ever been officially considered by the National Iron Roofing Association is denied by its President, Mr. Charles Aldrich, of St. Louis. It is not improbable, however, that some such a plan may be presented at the next meeting of the Association, which is to be held in Canton, O., on the second Wednesday in January, 1892. Whether it will be adopted or not is another question. In any event, the design is claimed to be, not to raise, but to regulate prices.

The Sheet Iron Association met at Pittsburgh last week and reaffirmed prices. The market is very dull at present and the outlook is not any too bright, but it is thought that the tinplate business will create an early demand for black sheets at least.

Not precisely in the line of a combination of different establishments, but rather of the purchase of a number of such by the same parties, is the successful consummation of the sale of several large iron works announced during the past week. It is stated on good authority that the following properties have just been sold to a syndicate composed of English and American capitalists: The New Jersey Steel and Iron Company, of Trenton; the Trenton, the Durham Iron Works, Mines and Furnaces, Durham, Pa.; the Passaic Rolling Mills, Steel Plant, Paterson; and the Warren Iron Company, Hackettstown, N. J. The purchase price to be paid by the syndicate for these businesses is announced at $5;000,000. All the companies named, with the exception of the Passaic Rolling Mills, are said to be controlled by Cooper, Hewitt & Co. The new organization is to be called the New Jersey Steel and Iron Works.

ENGLAND'S ANXIETY FOR OUR WELFARE.

The intense anxiety for the welfare of this country manifested by the English manufacturers and newspapers would be, indeed, touching if it were not so ludicrous. Of course everything is going to the bad on this side of the water, since the McKinley tariff went into effect, and as a natural consequence the panacea for all our ills, real and imaginary, is Free Trade. If, incidentally, the establishment of such a policy in the United States could open up for British manufacturers the richest markets in the world, that would, of course, be what Artemas Ward would call a "sweet boon," but perish the thought that our English friends are influenced by any such mercenary considerations! Occasionally, however, this deep anxiety for our welfare betrays itself into expressions which tend to arouse faint suspicions that, possibly—remember, we say, possibly—the mercenary motive may have something to do with it; as, for instance, a recent editorial in the *Iron and Coal Trades Review*, of London, entitled "McKinley and Trade." We haven't room for the entire article, but the two passages following, and placed side by side, may tend to elucidate the exact quality of milk in the cocoanut:

THE WAIL.

It is a curious fact, which will be taken note of on both sides of the Atlantic, that notwithstanding a high tariff, and even by the showing of American protectionist organs, the trade situation in the United States is again unsatisfactory, or was at the beginning of November. We have it on their authority that all prices refuse to advance, and that in some lines there is a falling-off in the demand as compared with a month ago. In the iron trade there is a slightly better feeling in the steel rail market, caused by the placing of orders for about 75 000 tons, at "full" prices, by which is meant the prices maintained by a powerful combination. In nearly every other branch of trade there is no improvement, while in some of them there has been positive retrogression. "Nobody seems to know" what is the matter with business generally, as an ingenuous American contemporary puts it. The true explanation seems to be that expectations of the beneficial operation of the McKinley tariff on national industry were strung so high by interested manipulators that the disappointment is all the more keenly felt. The Americans are beginning to see now that, while the new tariff, after being in operation for over a year, has not yet brought about an increase in the general prosperity of the country, nor increased wages to the working classes, it has raised prices upon nearly all the necessaries of life. There is no instance of any importance in which wages have raised since the new tariff went into effect. On the contrary, there are many notable cases, including that of the ironworks of Messrs. Carnegie & Co., in which wages have been lowered. In many parts of Ohio, where, the recent elections have shown, the McKinley creed is still the strongest, a reduction in wages has been general in the largest industrial establishments.

THE FACT.

It would be idle to endeavor to explain away the effect of the McKinley tariff upon British trade. The total exports of the United Kingdom to the United States for the three months ended June 30 last, compared with those of the corresponding quarter of 1890, showed a decline of close upon $9 000,000, the figures being $44,625,841 in 1891, and $53.329,066 in 1890. The iron trade bears its quota of this decrease. Amongst other items, we need mention only our shipments of cutlery, which fell from 396,165 in 1890 to $106 219 in 1891, or 73 per cent. Our exports of metals, and iron and steel manufactures declined in that quarter by 45 per cent., from $2 479 187 to $1,373,264 On the other hand, the shipments of tinplates rose from $5 104 596 to $12,865,877, or 152 per cent. This export business in plates, however, was abnormal, and due entirely, as has been pointed out before in our columns, to the rush of tinplates to the States before July 1 last. Our shipments of tinplates since that date have declined, as was fully expected, and it may be estimated that they will be about the same this year as in 1890.

By a most unhappy coincidence the same journal, on the succeeding page, prints an instructive article on the world's iron production which, unfortunately for its argument, shows that Protection America

leads all countries as an iron producer. Perhaps the following figures, placed in comparison, may tell the story as effectually as the entire article:

GREAT BRITAIN UNDER FREE TRADE.		UNITED STATES UNDER PROTECTION.	
Production of Pig Iron (Tons):		*Production of Pig Iron (Tons):*	
1882	8,586,680	1882	4 623 323
1885	7,415,469	1885	4,044,526
1886	7,009 754	1886	5 683 329
1887	7,359 518	1887	6,417,148
1888	7,998,969	1888	6 489 738
1889	8 522,824	1889	7,603 642
1890	8,001,000	1890	9,202 703
Production of Finished Iron (Tons):		*Production of Finished Iron (Tons):*	
1890	1,854,000	1890	2,558,000

It seems a trifle strange, doesn't it, that a country so hampered and shut in by a narrow and bigoted economic system (to use the customary language of our friends, the Free Traders) should with such prodigious strides go to the head of the column; but the stupendous fact remains, and no amount of Free Trade sophistry can explain it away.

"Is electricity a manufactured article?" is a problem with which the courts, the experts and the electrical journals are at present wrestling. The *Electrical World* answers the question by asking another, and this is where it lands: "As a matter of plain, straightforward equity, an electric station and gas works ought apparently to stand on precisely the same footing, but whether under our existing laws this can be permitted is another question. For example, is an establishment for the distribution and sale of power, whether transmitted by cable, steam or compressed air, a manufactory? If it is not, should the distribution of power by electricity be classified as manufacturing? On the other hand, is not the production by the consumption of coal of an available something for human advantage manufacture, whether it is a current of gas or of electricity?"

THE *Bulletin* of the American Iron and Steel Association, in copying the recent article in *The Iron Trade Review* descriptive of the old blast furnace in West Virginia, adds the following comments: "The above is a very interesting contribution to the early history of the American iron industry. We think it altogether probable that Brooke Furnace was the first in Virginia that was built west of the Alleghenies, but it was not the first furnace built west of that geographical division. There were several furnaces in Fayette county, Pennsylvania, before 1794, and one at Pittsburgh. Bourbon Furnace, on Slate creek, in Bath county, Kentucky, was built in 1791, and in 1792 Cumberland Furnace was built on Iron fork of Barton's creek, in Dickson county, Tennessee."

WHERE THE GREAT MANUFACTURING CITIES ARE LOCATED.

In opening his recent address before the Commercial Club of St. Louis, Census Superintendent Porter well said:

The municipal, industrial, and commercial life of civilized nations has invariably centered on its great river or inland water cities. The river cities of the Loire, the Rhone, the Garonne, and the Seine have for centuries controlled the destiny and added to the splendor of France. The rich and powerful towns of Germany may be found along the fertile valleys of the Aller, the Elbe, the Rhine, and on the Baltic; of Russia on the Volga, the Danube, and on the Black sea, while the secret of the wealth, power, and commercial supremacy of Great Britain lies on the banks of the Clyde, the Tyne, the Severn, the Mersey, and the Thames. What centers of water and railway distribution, of industrial energy, of commercial enterprise, of aggregated wealth, of political power, and of historic interest, the names of these renowned rivers suggest! They bring back memories likewise of a municipal life, which, in its development, has overturned ancient dynasties and left its impress upon nations. Great as these rivers and their magnificent and teeming cities are, conspicuous as they have been in modern history, influential as they have been in the industrial and commercial development of Europe, the present century has witnessed the growth of centers of commercial and industrial life along the superb waterways of our own continent, which has its counterpart in no one nation, but in all Europe. On the Hudson, the Great Lakes, the Delaware, the Mississippi, the Missouri, the Ohio, the Monongahela, the Saint Lawrence, the Arkansas, the Tennessee, the Cumberland, the Sacramento, and a dozen other rivers have sprung into existence cities that give glorious promise before the century closes; cities that can claim tribute from areas as vast in extent as some European nations, and which are destined to become as populous and opulent as the greatest centers of European population. At the rate of growth of the last decade the metropolitan district of New York will in twenty-five years exceed in population the metropolitan district of London, the area of the two districts being about the same, and the decade will bring the population of Chicago up to that of Berlin, of Philadelphia up to that of Vienna, and St. Louis up to that of the world's great emporium of commerce on the Mersey, Liverpool.

THE proposed new French tariff fixes the duty on agricultural machinery at 15 francs maximum and 9 francs minimum per 100 kilograms.

SPIRIT OF THE TRADE PRESS.

RECENT "BIG THINGS" IN AMERICAN IRON WORKS.

Great Capacity of the Edgar Thomson Furnaces.

The combined annual capacity of the nine Edgar Thomson furnaces is 645,000 tons. To this it is understood that two furnaces will be added in order to get an output sufficient to meet the requirements of the Duquesne plant extension. The two furnaces completed this year are of about 200,000 tons capacity. Molten metal will be conveyed from the Thomson to the Duquesne when the improvements under way and in immediate contemplation are completed.—[National Labor Tribune.

A Philadelphia Rolling Mill Gets a Big Contract.

The contract amounting to $2,500,000 has been closed with the Phœnix Iron Co. by the Northeastern Elevated Railroad Co., of Philadelphia, for an elevated railroad five miles in length, and the rolling mills will begin work at once. The road is to be double track, and the estimated cost is $500,000 a mile. The portion first to be built will extend from Amber street, which is 2½ miles north of Market street, south. The road will be of lattice construction, thus darkening the street as little as possible. It will be built to sustain a live load of two coupled locomotives, weighing 50,000 pounds each, these followed by loaded passenger cars of 40,000 pounds each. Any weight under this will strain no part of the structure more than one-fifth its ultimate strength. The minimum height in the open will be 14 feet above the street. —[National Car and Locomotive Builder.

Large Marine Engines.

The Frontier Iron Works of Detroit, has now under contract four triple expansion engines, all of which will contain new features. Two of them will be duplicates having cylinders 20, 32 and 54 inches by 42 inches stroke. These are for steamer No. 121, building by the American Steel Barge Co., and the McBrier-Mitchell boat, No. 88, in the yard of F. W. Wheeler & Co. The other two engines are for steamer No. 123 to be built at the yard of the American Steel Barge Co., and the steel boat building by Wheeler & Co. for the Hollisters and others. The cylinders of these engines will be the same, 23, 37 and 62 inches, but the stroke of the Hollister boat will be 44 inches while that of the barge will be but 42 inches. All of these big engines will be completed by the opening of navigation in the Spring. The Frontier Co. is also building a compound engine of 9 and 17 inches by 30 inches for stationary work.—[Marine Review.

The Largest Casting Ever Made in This Country.

The great ordnance works of the Bethlehem Iron Co., where $4,000,000 worth of work for the Government is being done, were visited one day last month by Hon. Benjamin F. Tracy, Secretary of the Navy, and Commodore Folger, of the Bureau of Ordnance. Taey witnessed the pouring of the largest casting ever made in this country, the head of a new forging press 180 tons in weight, and then saw a 13-inch rifle forged and two pieces of armor-plate flattened beneath the 125-ton steam hammer. The spectators stood on the platform of the open hearth steel furnaces opposite the casting-ground. The work was performed by the larger Whitworth forging press. The heated ingot was taken out of the gas furnace and placed beneath the powerful ram of the press. It was rapidly moulded and shaped, and it gradually grew longer and more slender beneath the force of the ram. The gun will be a 13-inch tube about forty or forty-two feet long. The party subsequently visited the hammer building, where a large and a small ingot were in the furnaces ready to be moulded by the world's largest steam hammer. The ingots were taken out and the Secretary witnessed the forging of a large and a small armor-plate. Both the Secretary and the Commodore expressed themselves as being highly pleased with the progress made on the Government contract.—[National Car and Locomotive Builder.

Some Recent Heavy Forgings.

The Cleveland City Forge & Iron Co., of Cleveland, recently turned out a large rudder frame for the United States Cruiser No. 2, named the New York. This rudder is about 20 feet high by 15 feet wide, and 38 inches thick at the heaviest part. The rudder stock is 18½ inches in diameter. The weight of the frame is between 13 and 14 tons. Another one being made is between two and three tons heavier, and is for Cruiser No 12. The rudder stock is 19½ inches diameter. The company recently shipped a beam strap for a Sound steamer which was 34 inches between end pins, or 36 feet 6 inches over all, and 16 feet 8 inches wide over all. The mean sections of the sides are 10¼ inches and 11⅜ inches, the finished weight being 36,310 pounds. A spare shaft for the Sound steamer Pilgrim was turned out not long since that weighed, finished, 68,200 pounds. It was 39 feet 5 inches long and 27 inches in diameter. The company will at once erect a large addition, 69x160 feet, to their turnbuckle department, to be of iron, except a portion of the walls to be of brick. A further extension in connection with this department is contemplated, to make a line of light and heavy drop forge or die work for railroads, etc. In the main forge the company have put in recently three additional large hammers, and at one of them a pair of 50-ton cranes, operating in all movements with steam.

COMMENTS ON LIVE THEMES.

Prospects of Tariff Legislation.

Likely enough, an elaborate bill, full of revolutionary changes in the present law, and in all its tendencies destructive of existing industries, may pass the House and be sent to the Senate, but its chances of getting through the latter body will be of the forlorn-hope kind. Or if—putting the matter at its worst—the bill, in consequence of some exceptional entanglement of extraordinary circumstances, should slip through the Senate, it could not escape the negative of the President, who is a protectionist to the very marrow of his bones, and who would not hesitate to annihilate with his veto a measure which he felt certain would precipitate industrial ruin upon the American people.

The real danger of a reversal of the McKinley tariff, or even of any material modification of its provisions in that direction, during the life-time of the Congress, is not sufficient to justify even one pang of anxiety.—[Industrial World, Chicago.

Making Cheap Iron in Ohio.

Bessemer pig iron goes in Pittsburgh at $15.25 per ton at the outside figure; gray forge $13 25@13.75. It is barely possible these irons may be produced at that figure in Pennsylvania and Ohio, but we doubt it.—[Tradesman, Chattanooga.

British Capital in America.

A "labor note" in the Philadelphia *Record* states that "British capitalists own 33 per cent. of the wealth in these United States." We doubt this very much, but if there is full measure of truth in it we should fancy that those British capitalists are not opposed to the protective tariff policy, and that as the British investors increase in America so will the British opposition to protection in this country decrease. Practically, all the investment referred to has been made in 20 years, and if the rate continues thus 40 years hence will see America owned by Britons. This looks like a frightful sort of prospect, and so it would be were the *Record* item reliable. Will that journal oblige with the proofs?—[National Labor Tribune.

A Department of Relative Statistics.

To my mind the most necessary department yet remaining to be set at work in its fiul measure of usefulness, is a Department of Relative Statistics, by which the relative conditions of the different States of this Union, and of this Union as compared to other countries, which may be brought into view. In the investigation of prices which are now going on, it will be clearly proved, if regard be given to the great staples or necessaries of life, that during the last 50 years (with the probable exception of the products of the forest which are becoming relatively scarce) there has been a continuous reduction in the prices of food, fuel, fibres and fabrics of all kinds, both in this and all other countries in which science and invention have been applied through the adoption and improvement of machinery to production and distribution. That information will be of great valne but the important point having regard to legislation is, to know how far the relative reduction in the cost and in the price of all these articles has corresponded in this and other countries. The relative statistics of prices year by year would have the greatest possible value in elucidating the currency and the tariff questions. The mere fact that prices are now lower than they used to be under different conditions is of very little importance unless we have this standard of relative prices in other countries under other conditions of currency and taxation, to which we may compare them year by year for a term of years. I should therefore expect one of the first developments of a permanent Census Bureau to be the establishment of a science of the comparative statistics of nations, than which nothing could be more important as a basis for intelligent legislation.—[Edward Atkinson in Engineering Magazine.

"STRAWS" IN THE WIND OF TRADE.

Return of Our Absent Gold.

America has shipped 87,000,000 bushels of wheat to Europe in the past two months, and has received therefor in the neighborhood of $85 000,000 in gold. This is a fair sample of the present prosperity of the country.—[Stoves and Hardware Reporter, St. Louis.

Next Year's Prospects in the Iron Business.

It is certain that there has been an enlarged consumption of iron during the present year, and that it is still going on, so that it is not improbable that the combination of circumstances which render it almost, if not quite, certain that the ensuing year will be a prosperous one in general business, will so enlarge the consumption of iron and steel as to furnish employment to all existing facilities and make it possible for a good manufacturing profit to be realized. Under the circumstances a natural increase in consumption of iron and steel products might be experienced without seriously disturbing the level of values, but extraordinary profits in this line seem to be permanently gone.—[Cincinnati Price Current.

The Great Agricultural Yield.

The estimate of crop percentages furnished by the Department of Agriculture, when translated into quantities and put in the concrete form, provides decidedly pleasant reading. So far as regards wheat, the expectations of the most sanguine persons appear to have been fully realized. The yield has reached almost if not quite 600,000,000 bushels. When we bear in mind that this exceeds the largest output hitherto, that of 1884, to the extent of 87,000,000 bushels, and that it is 200,000,000 ahead of the yield of 1890, we can form something like an adequate conception of the immense proportions of the crop. Corn, too, reaches high figures—the yield this year is put at 2,000,000,000 bushels, while that of 1889 was 112,000,000 in excess of this. The other cereal crops, also, come up to or near the greatest previous yield. Cotton is not so heavy a crop as in 1890, but owing to the low prices the falling off here does not call out many regrets. Potatoes are above the yield of any year since 1880; hay is an average crop, and tobacco is in excess of the average.—[Ohio Valley Manufacturer.

The Easier Tone of the Money Market.

A better tone of feeling is almost everywhere conspicuous. There is an accumulation of loanable capital; and a gratifying change in monetary confidence is reported from London which, with other circumstances, has produced a responsive improvement in the general aspect of our loan markets at New York and other financial centres. The annoucement that the British Government has decided to recommend the issue of one pound notes was explained on Wednesday by Mr. Goschen, the Chancellor of the Exchequer, at the Merchant Tailors' banquet. The notes are to be issued by the Bank of England, redeemable in silver or gold, and their effect, as is anticipated, will be to give ease and stability to the money market and favor the efforts of the banks for accumulating gold reserves by taking the place of part of the coin now used in the channels of English commerce and trade. These new arrangements, with the publicity and frequent reports of the banks, are looked forward to with much interest, and their effects on the British money market are expected to favor the demand for our securities from investors, as the rate of interest will probably be more steady and tranquil. They will therefore be more conducive to that state of public confidence which will facilitate changes in the investment of foreign capital and promote its flow into American bonds, and railroad or other corporate securities.—[American Banker.

Heavy Purchases of Steel Rails and Rolling Stock.

Sales of steel rails within a week or ten days foot up about 200,000 tons, most of which will be made in Western rail mills. Pennsylvania mills booked orders for about 65,000 tons, and there are at this writing inquiries for nearly 100,000 tons. The Norfolk & Western wants 15 000 tons, mill price, $30. There is a more active inquiry for all kinds of crude iron and heavy transactions in Bessemer, pig, steel slabs and billets as well as spiegel and ferro manganese will probably take place before the holidays. Large car building contracts have been placed and others are soon to follow. One authority states that within 30 days car building contracts will be placed amounting to fully 20,000 cars. This means heavy orders for wheels, axles and general iron work, sufficient to give the iron trade a much needed impulse. It will hardly be felt before January 1, but there are increasing signs that a great deal of material will be contracted for early in the year for delivery along through the Spring and Summer as wanted. Then again, there is the possibility of an advance in quotations when these general requirements will be placed, but the rank and file of buyers would prefer to wait and pay a slight advance, under the assurance that better conditions were actually at hand. Civil and mechanical engineers who are qualified to speak on the subject, say that there is a larger amount of new engineering work on the drawing room boards than there has been for twelve months.—[Railway Review.

Within a month, including this issue, we have recorded orders for 25,000 freight cars placed in various car works. This is about one-fourth of a good average year's output for the private car shops. This important industry, therefore, has a very different aspect from what it showed a month ago, when most of the shops were very dull. We understand that the contract prices are still very low, but at least the shops will be paying wages and buying material. One of the strange business phenomena of this Autumn has been the slowness of the railroads in ordering material, in the face of unprecedented volume of business, greatly increased earnings and a universal shortage of equipment. The reasons have no doubt been almost altogether in the money market, and these are pretty well known.—[Railroad Gazette.

The long expected revival in the steel-rail trade has at last commenced. About the middle of November an informal agreement was reached between the Pennsylvania Railroad Co. and the owners of the Pennsylvania, Cambria and Edgar Thomson Works for the delivery of 60,000 tons of steel rails in 1892—one-third going to each company. This agreement has since been confirmed. About the same time contracts were closed with Western mills for large lots of rails, including the following orders: Chicago, Burlington and Quincy, 35,000 tons; Chicago & Northwestern, 40,000 tons; Chicago & Rock Island, 16,000 tons. Last week several other large orders for rails were given out, and our steel-rail mills may now be said to be provided with work enough to carry them through the Winter, which condition removes the only cloud upon the prospects of our steel-rail industry for the whole of 1892. The orders which were placed last week were as follows: The Norfolk & Western, 10,000 tons to Sparrow's Point and 5,000 tons to Edgar Thomson; the New York, Lake Erie & Western, 10,000 tons to Scranton and 10,000 tons to Edgar Thomson; the Big Four, 25,000 tons to Edgar Thomson—in all 60,000 tons, making, with the 60,000 tons of the Pennsylvania, 120,000 tons in all which have recently been ordered in the East. The recent orders in the West exceed 100,000 tons. All sales have been made on the basis of $30 at Eastern mills. We may also add to the above a sale of 5,000 tons by the Edgar Thompson people to the Cincinnati Southern, and another sale by the same company of 5,000 tons to a railroad company which we cannot name, and numerous small orders to other companies, all recently placed.—[Bulletin of the American Iron and Steel Association.

AN INDIANA ROLLING MILL'S BIGGER RECORD.

TO THE EDITOR OF THE IRON TRADE REVIEW:

We notice in your issue of November 26, under the heading of "An Ohio Rolling Mill's Big Record," that the Massillon, O., correspondent of the *National Labor Tribune* calls attention to the record of a 10-inch mill at Girard, O., which made a run on one turn of 47,090 pounds, thus beating the famous Joseph Corns record of the year previous by 600 pounds, and stating further that a 9-inch mill, at Massillon, turned out on one run 49 858 pounds. In view of this article I desire to call your attention to the record of the New Albany Forge & Rolling Mill, at New Albany, Ind. A 10-inch guide mill with two furnaces running turned out the following, viz.:

	Pounds.
January 17, 1891	57,849
" 22, 1891	47,046
February 6, 1891	62,081
" 7, 1891	64,221
" 9, 1891	62,897
" 10, 1891	43,777

The Hoosiers will take pleasure in teaching the Buckeyes how to run a mill if they will come down. Yours faithfully, WM. L. BREYFOGLE.

LOUISVILLE, Ky., Dec. 4, 1891.

HOLIDAY rates on the Nickel Plate, December 23d to January 1st, inclusive Returning to January 5th, 1892. One fare for the round trip.

THE IRON-ORE ROUND-UP.

'91'S SHIPMENTS 1,500,000 TONS SHORT OF '90'S.

Lake Superior Port Shipments, 6,490,205 Tons—Receipts at Lake Erie Ports, 4,939,684 Gross Tons—Amount on Dock December 1st, 3,508,489 Tons—Practically No Unsold Surplus.

The year 1891 marked a decided restriction in the output of Lake Superior iron mines. This was the logical sequence of the "big year," 1890, when the production reached the enormous figure of more than 9,000,000 tons. The result has been a sharp reduction in the receipts at Lake Erie ports, though the sales for the year have been very large. Official figures collected by *The Iron Trade Review*, according to its annual custom, show that there were on dock at Lake Erie ports at the opening of navigation May 1st, 1891, 2,400,000 gross tons of ore. The total receipts for the season of 1891 (closing December 1st) were 4,939,684 tons, making a total of 7,339,684 tons. Of this there were shipped to furnaces by rail from Lake Erie ports during the season of 1891, 3,831,195 tons, leaving on dock December 1st, 3,508,489 tons, as against 3,893,487 tons on dock at the close of navigation last year. This shows a decrease of ore on dock this year of 384,998 tons from last year at the same time. The detailed figures as to receipts for the past nine years are given in the subjoined table:

TOTAL RECEIPTS AT LOWER LAKE PORTS FOR NINE YEARS.

Port.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Toledo	27,617	2,44[illegible]	15,000	29,960	61,729	75,601	82,961	164,295	191.103
Sandusky	58,825	106,540	143,180	157,970	160,600	154,924	186,682	174,596	105,907
Huron	.....	.....	.....	44,021	21,285	4,351	680	1,200	14,910
Lorain	25,794	30,15[illegible]	13,180	99,744	134,764	197,000	280,000	280,450	266,009
Cleveland	723,125	904,850	589,234	1,034,650	1,216,423	978,775	1,742,415	1,945,492	1,257,775
Fairport	40,331	23,100	31,932	112,000	501,368	611,140	819,121	1,095,408	699,434
Ashtabula	673,000	650,000	582,000	672,030	1,123,839	1,288,530	1,963,490	2,176,780	1,599,785
Erie	106,787	116,027	122,223	91,250	204,880	240,33[illegible]	373,595	487,493	393,759
Buffalo	40,203	8,760	7,162	31,869	28,699	240,000	298,000	548,000	410,000
Total	1,692,63[illegible]	1,841,81[illegible]	1,503,959	2,270,554	3,439,198	3,783,659	5 856,344	6,874,664	4,939,684

The following table shows the iron ore stocks on hand at the close of navigation in the years respectively stated:

IRON ORE ON DOCK AT CLOSE OF NAVIGATION.

Port.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Toledo	25,000	18,000	12,000	15,000	52,000	53,255	85,340	110,740	122,515
Sandusky	44,083	72,834	87,457	80,000	65,000	100,000	175,000	115,000	122,003
Huron	.....	.....	.....	8,500	11,700	9,200	39	1,200	14,910
Lorain	25,611	35,927	34,346	69,304	110,000	100,000	170,000	210,237	250,8[illegible]2
Cleveland	428,654	482,23[illegible]	494,68[illegible]	464,691	487,327	527,616	518,816	1,209,467	1,114,762
Fairport	15,000	2,100	7,500	7,000	223,318	250,000	390,000	721,000	597,617
Ashtabula	291,878	249,306	331,110	285,697	521,516	686,833	1,071,011	1,151,317	933,957
Erie	95.3[illegible]	77.750	81,844	35,000	89,000	95,092	128,900	248,714	252,916
Buffalo	17,500	None	None	None	None	26,500	63,000	125,732	129,000
Total	943,095	1,038,135	1,048,940	956,472	1,558,861	1,848,555	2,607,106	3,893,487	3.508,489

The amount of unsold ore on dock at the close of the season this year we estimate at 60,000 tons, though much of this is of such grades and so scattered as to be practically unsalable. The proportion of sold and unsold stock at Lake Erie ports on the dates named has been as follows:

Date.	Sold.	Unsold.	Per cent. Unsold.
December 1, 1884	388,135	650,000	62.6
December 1, 1885	918,940	130,000	12.4
December 1, 1886	896,472	70,000	7.2
December 1, 1887	858,851	750,000	48.1
December 1, 1888	1,681,255	167,300	9.
December 1, 1889	2,537,106	70,000	2.6
December 1, 1890	3,893,487	None.	....
December 1, 1891	3,448,489	60,000	.017

At the close of last year's shipping season, practically not a pound of unsold ore remained on dock. The sales of 1891 for Lake Erie delivery would, therefore, appear to be represented by the total receipts less 60,000 tons of unsold ore on dock, or a total of 4,879,684 tons.

The total shipments from Lake Superior ports for 1891 were 6,490,205 tons, of which 4,939,684 tons were sent to Lake Erie ports, leaving 1,550,521 tons as the amount shipped to Chicago and other Northwestern points up to December 1st. The Chicago and Northwestern shipments in 1890 were 1,271,186 tons, and in 1889, 1,288,588 tons.

The decrease in receipts at Lake Erie ports this year from 1890 has been 1,934,980 tons or 28 per cent. The decrease in the amount on dock over 1890 is a trifle less than 10 per cent.

As will be seen, the several ports retain the same relative rank as last year, Ashtabula leading, with Cleveland a close second, but the difference between these ports is a trifle wider this year than last. The receipts at Buffalo and Erie were 803,759 tons, of which probably something over 500,000 tons were for shipment to furnaces east of the Alleghenies, against 680,000 tons last year.

Ore rates from Escanaba to Lake Erie ports, which closed in 1890 at $1.15, opened at 80 cents, and in a very short time dropped to 55 cents (the lowest rate in 1890 was 85 cents), advanced to $1.05 by September 24, declined in October to 65 cents, improved, and closed the season at $1.30. The rates from the head of Lake Superior showed the same changes. During last Winter charters were made from Ashland at $1, but by the opening of navigation in the Spring rates were down to 90 cents, and later declined to 80 cents. From this point there was an advance to $1.40, then a decline to 95 cents, and the closing charters were made at $1.40.

SHIPMENTS OF LAKE SUPERIOR IRON ORE FOR 1891.

By the use of the wires we are enabled to present herewith a close estimate of the shipments of iron ore from Lake Superior ports for 1891 up to December 8, which practically closed the season. The subjoined estimate is telegraphed us by Mr. George A. Newett, the able and painstaking editor of *Iron Ore*, Ishpeming, Mich., and may be taken as very close to the actual figures (comparison being had with similar figures for 1890):

SHIPMENTS OF IRON ORE FROM LAKE SUPERIOR PORTS.

	1891.	1890.	Gain '91.	Loss, '91.
Escanaba	4,063,000	3,714,652	.....	654,652
Marquette	1,100,003	1,307,395	.....	207,395
Ashland	1,253,326	2,123,856	.....	870,530
Gladstone	191,359	91,091	100,267	.....
Two Harbors	835,521	826,063	59,458	.....
Total	6,490,205	8,063,067	159,725	1,732,587

The net decrease in Lake Superior shipments in 1891 from 1890 is 1,572,862 tons, and the total shipments for 1891 are within less than 10,000 tons of the amount heretofore predicted by *The Iron Trade Review*, viz.: 6,500,000 tons. Of course the above totals do not represent the production of the Lake Superior mines for the years stated. In the year 1890 the total production was 9,003,701 tons, or about 800,000 tons in excess of the water shipments.

To the kindness of the *Marine Review* we are indebted for the following table showing the business of the Sault Ste. Marie Canal, complete, for the years stated:

	1889.	1890.	1891.
Total freight, tons	7,516,022	9,041,213	8,888,759
Passenger	25,712	24,850	26,166
Coal, tons	1,629,197	2,176,925	2,507,532
Flour, barrels	2,223,707	3,239,104	3,780,143
Wheat, bushels	16,231,854	16,2[illegible]7,370	38,8[illegible]6,670
Iron ore, tons	4,0[illegible]5,855	4,774,768	3,560,213
Lumber, M feet	315,554	361,929	3[illegible]6,305
Copper, tons	33.45[illegible]	43,749	69,190

The decrease in iron ore and gain in coal will be noted.

THE MAGNETIC CONCENTRATION OF IRON ORE.

At the Glen Summit meeting of the American Institute of Mining Engineers, held last October, Mr. W. H. Hoffman, General Manager of the Croton Magnetic Iron Mines, Brewster, N. Y., read a very interesting paper on "Practical Results in the Magnetic Concentration of Iron Ore." The paper in question gave the details of practical tests made under Mr. Hoffman's direction and are of greatest interest to iron men.

The Hoffman Magnetic Separator (patented by W. H. Hoffman, November 17, 1891) has now been in operation at the concentrating mill of the Croton Magnetic Iron Mines, at Brewster, N. Y., for six months. Several separators have been tried but none, it is claimed, have produced results equal to those of the Hoffman machine. Its principal features are cutting down the percentage of iron lost in the tailings to the lowest possible limit, the rapidity with which ore is handled, and the high percentage in iron of the finished product. The machine also effectively removes the phosphorus, and requires scarcely any repairs or renewals. During the period of six months' operation at the Croton mines, not a single portion of any of the separators has been renewed, nor have they been stopped by the failing of any of their parts. The power required is three-fourths of one horse-power mechanically, and two horse-power electrically. Sixteen tons per hour of Croton ore have been handled on one separator, with a 13-inch width of working face on magnets and belt, the middlings being sent to a set of rolls for regrinding. A change was then made in the crushing plant by which the entire grinding of the plant (300 tons in 12 hours) was done by two Sturtevant mills, the coarse material from the mill screens being returned directly to the Sturtevants. This produced such uniform grinding that the Cornish rolls of the plant were dispensed with, as were also the rolls for grinding the middlings of the separators. These middlings are now returned directly to the separator hopper by a short elevator beside each machine, this repassing the material until it becomes either finished product or tailings. The Croton ore is especially difficult to handle on a magnetic separator, as it requires roasting to eliminate the sulphur, and the ore often comes to the separator at a tempature of 200°. It was at first thought the rubber carrier belt would not stand this temperature but they have never given any indication of injury or wear. Machines are now in course of construction having belts and magnets 20 inches wide, which will greatly increase the present capacity. The Hoffman Separator is also designed to handle furnace slags for reclaiming the iron they contain. Several samples of different ores are now being tested for the purpose of placing the separator at the respective mines. Mr. W. H Hoffman, in his paper above referred to, gives the following average of two weeks' shipments for June, July, August and September, 1891:

	June.	July.	Aug.	Sept.
Iron	68.55	68.03	68.25	70.09
Phosphorus	.036	.036	.030	.045
Sulphur	.240	.340	.475	.170
Silica	3.5	3.6	2.4	2.5

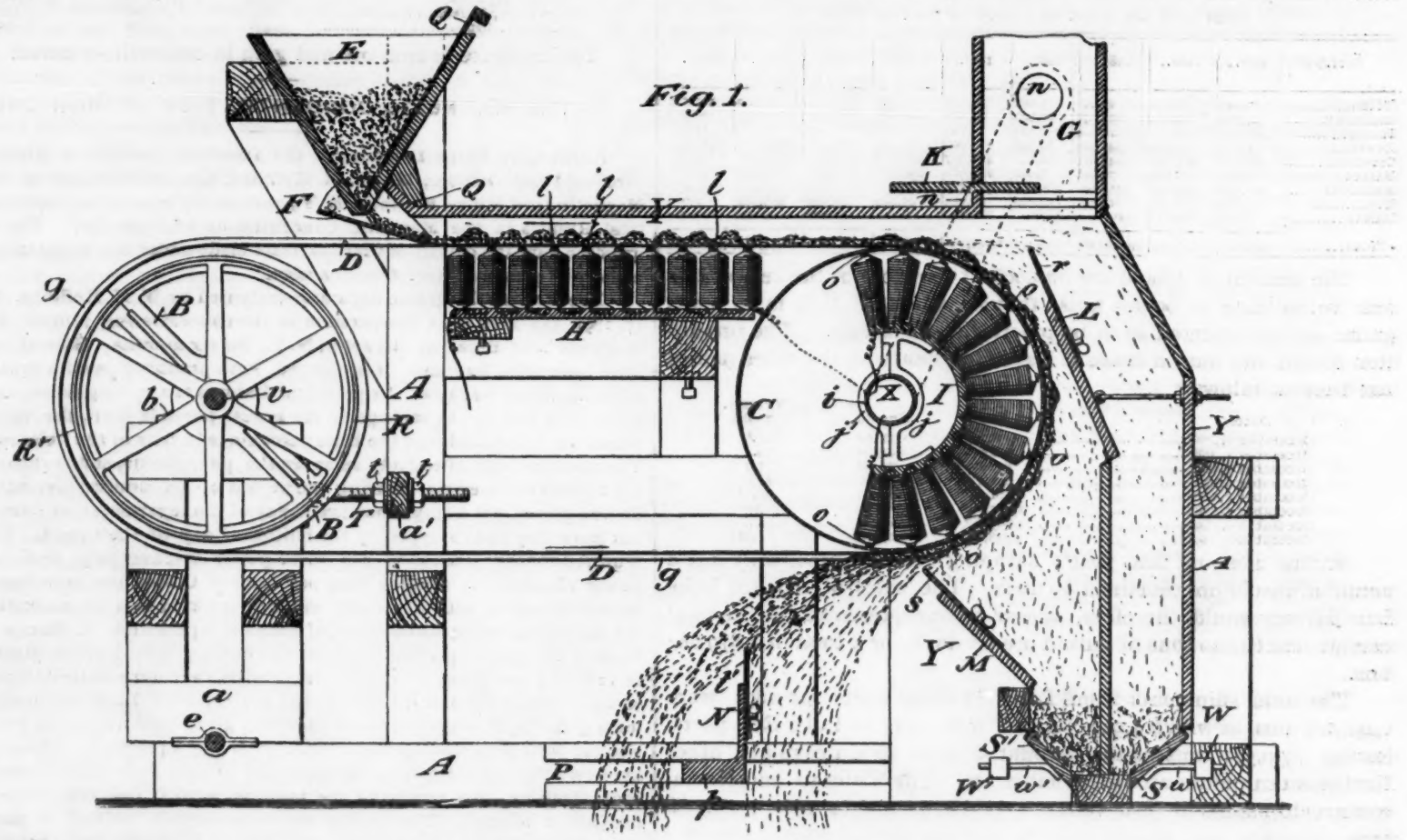
This represents the work of the Hoffman separator on an ore running in iron from 26 to 40 per cent. say an average of 33. The ore in the Croton

mine averages in iron 40 per cent. and over, but at present the managers are consuming the old dumps which frequently go as low as 25 per cent. iron. The phosphorus in the crude ore during this time averages .300, the sulphur 2.50. The metallic iron in tailings during these four months was as follows:

June.	July.	Aug.	Sept.
10.10	9.3	8.41	8.02

For October and November the shipments have averaged: Iron, 65 85; phosphorus, .050; sulphur, 0.67. The tailings for these two months have averaged 7.67.

Supplementary to the above we present herewith the first cuts yet made of the Hoffman separator. Fig. 1 is a view of the separator in vertical longitudinal section, the magnets being shown in end elevation. Fig. 2 is a view in detail, showing the drum for conveying the material within the field of the curved line of the magnets and the parts in immediate contact therewith. The operation is as follows: The belt D, having been set in motion in the direction indicated by the arrows, an upward current of air along the periphery of the drum C having been established by the exhaust mechanism and the electro-magnets having been energized, the material to be separated is allowed to pass from the hopper E onto the chute F, and is fed thence upon the belt D, which carries it along within the field of the magnet H. As the said material comes within the field of the magnet H, the particles subject to magnetic influence are attracted toward the nearest pole, and at the same time are carried along by the belt past the succession of opposite poles. As the said particles pass the successive poles of the magnet they do not follow the line parallel with the belt D, but assume positions under the influence of the magnetic lines of force, which are in the forms of curves from the end of one pole to the end of the nearest pole of opposite polarity. The degree of curvature will depend upon the strength of the magnetic force and the distance between the poles of opposite polarity. By following these curves and at the same time being moved along by the belt, the material to be separated assumes a rising-and-falling or wave-like motion. This motion results, first, in the gathering together of the magnetic particles from the mass by their attraction for each other and by the force tending to draw them toward the nearest magnetic pole and consequently nearest the belt, and, secondly, in tending to bring particles of greatest specific gravity nearest to the bottom of the mass on the belt D, and consequently nearest the poles of the magnet. The above described wave-like motion causes an expulsion of the slightly-magnetic or non-magnetic material, and that of least specific gravity toward the top of the mass on the belt, and results finally in a stratification of the substance to be separated, the most magnetic and heaviest portions being brought closest to the belt, and the lighter and non-magnetic or slightly magnetic particles farthest from the belt. The jigging motion or violent agitation of the particles of the mass of material, as above described, results in an effective scouring action, which tends to clean their surfaces and thereby free them from such impurities as slightly adhere to them—as, for example, phosphorus or silica in the case of magnetic impurities thus freed are expelled from the magnetic portions of the mass by the above-described action, and arrange themselves in the stratum farthest from the belt. In such a stratified condition the mass to be separated passes from the field of the magnet H into the field of the magnet I. As the belt follows its path around the periphery of the drum C, the mass just before leaving the horizontal line of the belt's motion enters the field of the magnet I, and the magnetic particles once more assume the directions of the line of force in curves from one pole to its nearest opposite pole. In the form represented the magnet I, the poles *o* being farther apart than the poles *l* of the magnet H, the curves which the magnetic particles assume will be less sharp.



The magnetic particles having been arranged by the preparatory magnet H into a stratum in proximity to the surface of the belt, it becomes feasible to employ a magnetic force sufficiently strong to act upon the entire stratum of partially-separated magnetic particles. The non magnetic and lighter particles forming the upper stratum will, under the horizontal motion imparted to them by the belt, leave the magnetic stratum in a trajectory as the belt begins to follow around the periphery of the drum C, and will be assisted in separating itself from the magnetic stratum by the lifting and wedging action of the upward current of air following along between the periphery of the drum C and the upper portion of the partition L. Just what part of the upper stratum shall be allowed to finally escape and be permanently separated from the lower stratum is determined by means of the partition L and its sliding section *r*. Such portion as passes over the section *r* falls to the base of the space between the casing Y and the partition L, and as it accumulates in a sufficient quantity

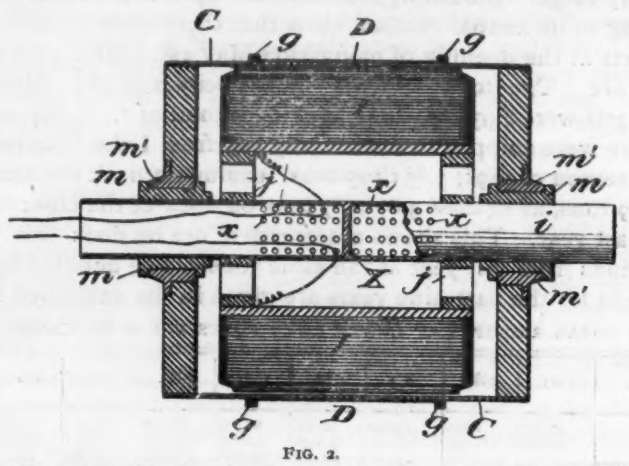


Fig. 2.

automatically opens the gate S and escapes. The magnetic stratum follows the path of the belt D around the periphery of the drum C by reason of the attraction to the magnet I and its wave-like motion is continued, constantly gathering the more highly-magnetic particles closer to the poles and consequently to the belt D. This wave-like motion also continues to expel to the surface all the slightly-magnetic substances which gradually fly from the surface under the centrifugal force, and as the mass passes the transverse horizontal axis of the cylinder, being aided by the force of gravity. During its passage around the periphery of the drum C a scouring action is kept up upon the surface of the mass by the opposing current of air and by the agitation of the mass, which effectually brings all of the particles into contact with the air-current. The intensity of the air-current may be regulated by the speed of the exhauster and by the adjustments of the several slides in the partitions. The slightly-magnetic particles, together with such non-magnetic particles as were not at first separated from the mass, fall from the surface of the belt into the space between the partitions L and M, and as they accumulate in sufficient quantities are automatically discharged through the gate S'. After passing the partition M the less magnetic material continues first to fall from the belt, while the more-magnetic is still carried forward and finally leaves the belt after the latter has carried it beyond the holding force of the last pole of the magnet I. The adjustable partition N serves to separate this last mass of material as it falls from the belt, so as to retain a pre-determined percentage of purity in that portion which is the most magnetic.

COAL AND ORE HANDLING MACHINERY.

The tendency of machinery for unloading vessels and for handling coal, iron ore and similar materials, has been towards more rapid work, and at a less expense per ton, necessarily requiring machinery that is heavier, more complex and more expensive. The change from doing the work almost entirely by hand to the present method of doing the work wholly by machinery has been a gradual one. The first method required a great amount of hard physical labor. The present method requires but little exertion on the part of workmen, but requires more skill, entails greater responsibility, and a higher rate of wages per day.

The advances from the primitive method of handling, by means of baskets, through the various processes of wheeling, hoisting by horse-power, etc., had not been very rapid until the introduction of automatic machinery, one of the most efficient types of which is the Hunt Automatic Railway. This railway is operated entirely by gravity needing neither steam, horse nor manual power. The car runs down the track, dumps the load, and returns to the loading place automatically. The workman does not accompany the car, and has ample time, while the car is making the trip, to weigh the coal and enter it in his weight-book. With one man only, the coal can be weighed and stored in any desired bin within 500 or 600 feet of the vessel. As the carrying capacity of this car is over 60 tons per hour, the number of shovelers in the hold of the vessel was increased to three, and the coal was hoisted by a small steam engine. The output now was about 15 tons per hour, or 150 tons per day, with a total of five men employed; three shovelers, one hoister and one attending the automatic car, or an average of about 25 to 30 tons per day for each man employed.

The increase in the speed of handling by the use of the steam engine and the automatic car, made the swinging of the bucket, as it came out of the hold, whether using an ordinary gaff or hoisting from a sling from the mast head, very objectionable. This was overcome by the use of the "Hunt elevator," which had inclined booms running out over the vessel, the bucket being hoisted vertically until it reached the booms, and then guided by a track up to the point desired. The output per day with this machine was about thirty-five or forty tons per day for each man employed.

To reduce the expense of shoveling, and at the same time to increase the daily output, the manufacturers devised a steam shovel, which fills itself when lowered on the coal, and carries from 1 to 1½ tons to a load. It is entirely automatic, both in filling and in dumping, so that no one is required on the vessel in any way, except toward the last to scrape the coal out of the corners. As this shovel and its load weigh about 6,000 pounds, a very great increase in the size of the hoisting engine was necessary, and to the power of these massive engines has been added a specially designed governor, by means of which changes of speed can be made entirely independent of the throttle valve, or the engineer.

The shovel carries over a ton of coal at each trip, and will make a round trip in about forty five seconds, but the average speed of unloading in discharging cargoes is from fifty to seventy tons per hour at each hatch, with one man on the vessel, one at the engine to hoist and one to attend the automatic car, making a total of three men who take out from five hundred to seven hundred tons per day, or from one hundred and sixty to two hundred and thirty tons per day for each man employed at the work; thus the efficiency of one man's work has been increased, by the use of modern machinery, from three to over two hundred tons per day of ten hours, or in the proportion of about seventy to one, and the increase since 1873, when Mr. Hunt began the introduction of his automatic machinery, has been about twenty to one, and at the same time the physical exertion of the laborer is much less severe, and the wages paid to the workmen per day nearly fifty per cent. greater. The automatic railway answers the purpose of conveying coal for distances of 600 feet or less, but beyond that a different method is necessary. For this purpose a cable railway is used in which the cars are drawn by a wire cable running the whole length of the track and driven by power.

From a host of illustrations showing the applications of this system, we select a few as being of more especial interest to our readers. Further particulars can be obtained by addressing the C. W. Hunt Co., 45 Broadway, New York.

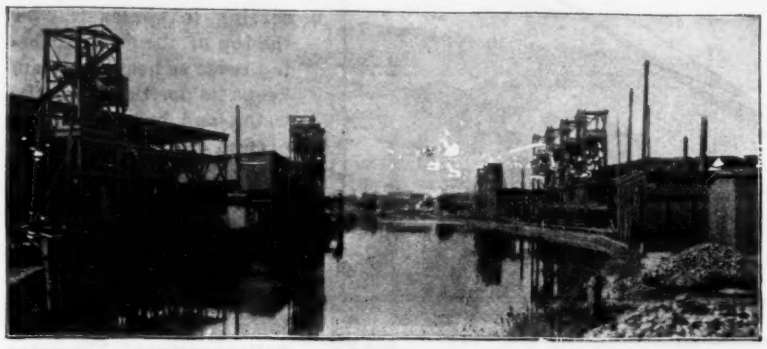


FIG. 1—Coal Handling Machinery in Milwaukee, Wis. H. M. Benjamin, Pennsylvania Coal Co., and R. P. Elmore Co.

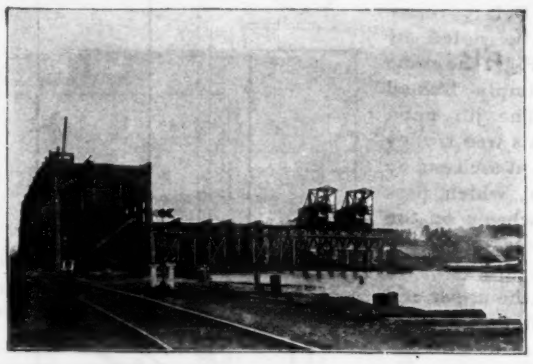


FIG. 4—Columbus & Hocking Coal & Iron Co., Manitowoc, Wis. Four Movable Elevators, Automatic Railways and Pockets for Coaling Locomotives.

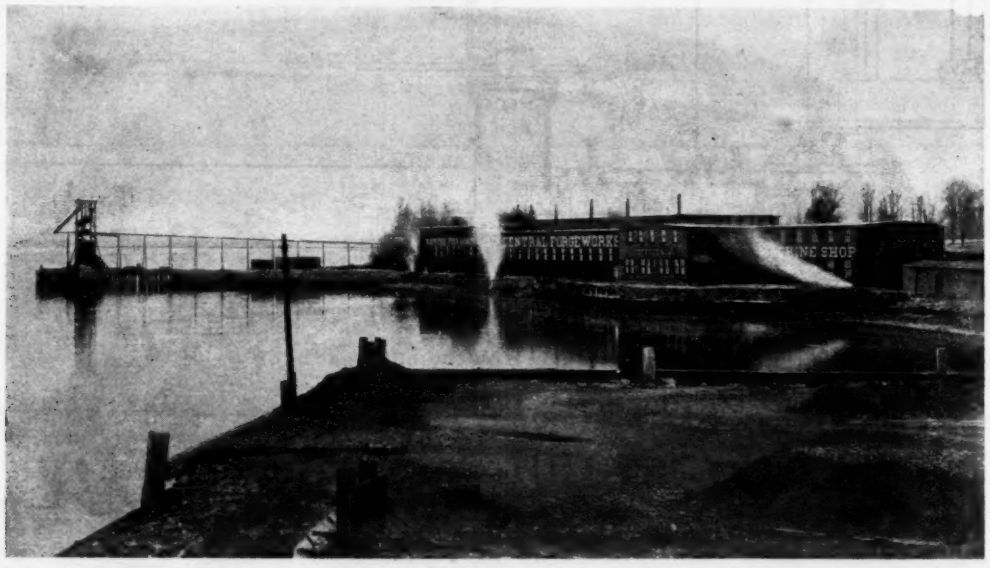


FIG. 2.—Central Forge Works, Whitestone, N. Y.

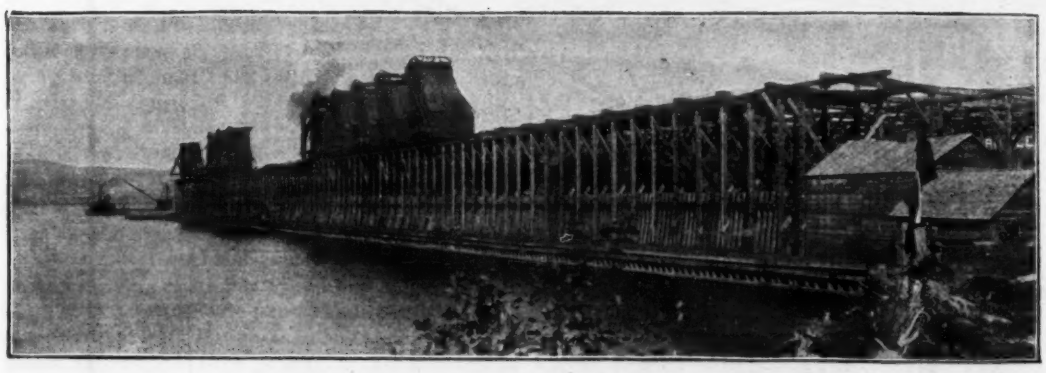


FIG. 3—Lehigh Coal & Iron Co., West Superior, Wis. Fitted with Hunt Machinery, wharf 2,000 ft. long, 300 ft. wide. Nine Elevators and 75 Automatic Railways—Capacity for unloading from vessels, 7,000 tons per day.

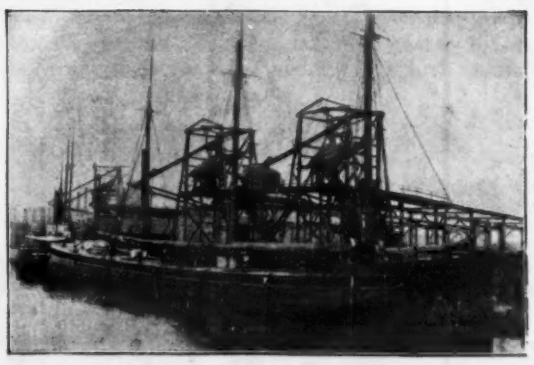


FIG. 5—Joliet Steel Co., Chicago, Ill. Six Elevators and Automatic Railways for handling Iron Ore.

mine averages in iron 40 per cent. and over, but at present the managers are consuming the old dumps which frequently go as low as 25 per cent. iron. The phosphorus in the crude ore during this time averages .300, the sulphur 2.50. The metallic iron in tailings during these four months was as follows:

June.	July.	Aug.	Sept.
10.10	9.3	8.41	8.02

For October and November the shipments have averaged: Iron, 65 85; phosphorus, .050; sulphur, 0.67. The tailings for these two months have averaged 7.67.

Supplementary to the above we present herewith the first cuts yet made of the Hoffman separator. Fig. 1 is a view of the separator in vertical longitudinal section, the magnets being shown in end elevation. Fig. 2 is a view in detail, showing the drum for conveying the material within the field of the curved line of the magnets and the parts in immediate contact therewith. The operation is as follows: The belt D, having been set in motion in the direction indicated by the arrows, an upward current of air along the periphery of the drum C having been established by the exhaust mechanism and the electro-magnets having been energized, the material to be separated is allowed to pass from the hopper E onto the chute F, and is fed thence upon the belt D, which carries it along within the field of the magnet H. As the said material comes within the field of the magnet H, the particles subject to magnetic influence are attracted toward the nearest pole, and at the same time are carried along by the belt past the succession of opposite poles. As the said particles pass the successive poles of the magnet they do not follow the line parallel with the belt D, but assume positions under the influence of the magnetic lines of force, which are in the forms of curves from the end of one pole to the end of the nearest pole of opposite polarity. The degree of curvature will depend upon the strength of the magnetic force and the distance between the poles of opposite polarity. By following these curves and at the same time being moved along by the belt, the material to be separated assumes a rising-and-falling or wave-like motion. This motion results, first, in the gathering together of the magnetic particles from the mass by their attraction for each other and by the force tending to draw them toward the nearest magnetic pole and consequently nearest the belt, and, secondly, in tending to bring particles of greatest specific gravity nearest to the bottom of the mass on the belt D, and consequently nearest the poles of the magnet. The above described wave-like motion causes an expulsion of the slightly-magnetic or non-magnetic material, and that of least specific gravity toward the top of the mass on the belt, and results finally in a stratification of the substance to be separated, the most magnetic and heaviest portions being brought closest to the belt, and the lighter and non-magnetic or slightly magnetic particles farthest from the belt. The jigging motion or violent agitation of the particles of the mass of material, as above described, results in an effective scouring action, which tends to clean their surfaces and thereby free them from such impurities as slightly adhere to them—as, for example, phosphorus or silica in the case of magnetic impurities thus freed are expelled from the magnetic portions of the mass by the above-described action, and arrange themselves in the stratum farthest from the belt. In such a stratified condition the mass to be separated passes from the field of the magnet H into the field of the magnet I. As the belt follows its path around the periphery of the drum C, the mass just before leaving the horizontal line of the belt's motion enters the field of the magnet I, and the magnetic particles once more assume the directions of the line of force in curves from one pole to its nearest opposite pole. In the form represented the magnet I, the poles *o* being farther apart than the poles *l* of the magnet H, the curves which the magnetic particles assume will be less sharp.

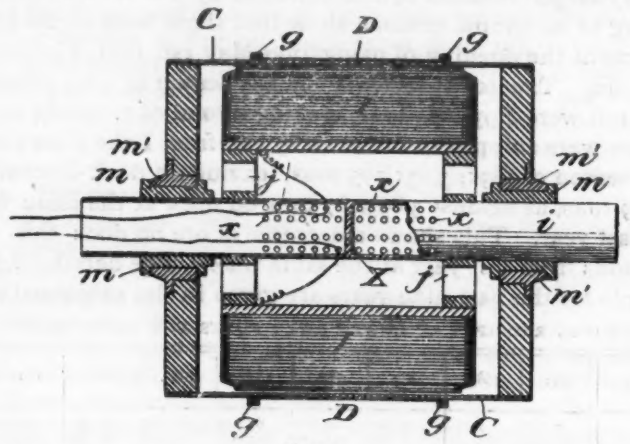
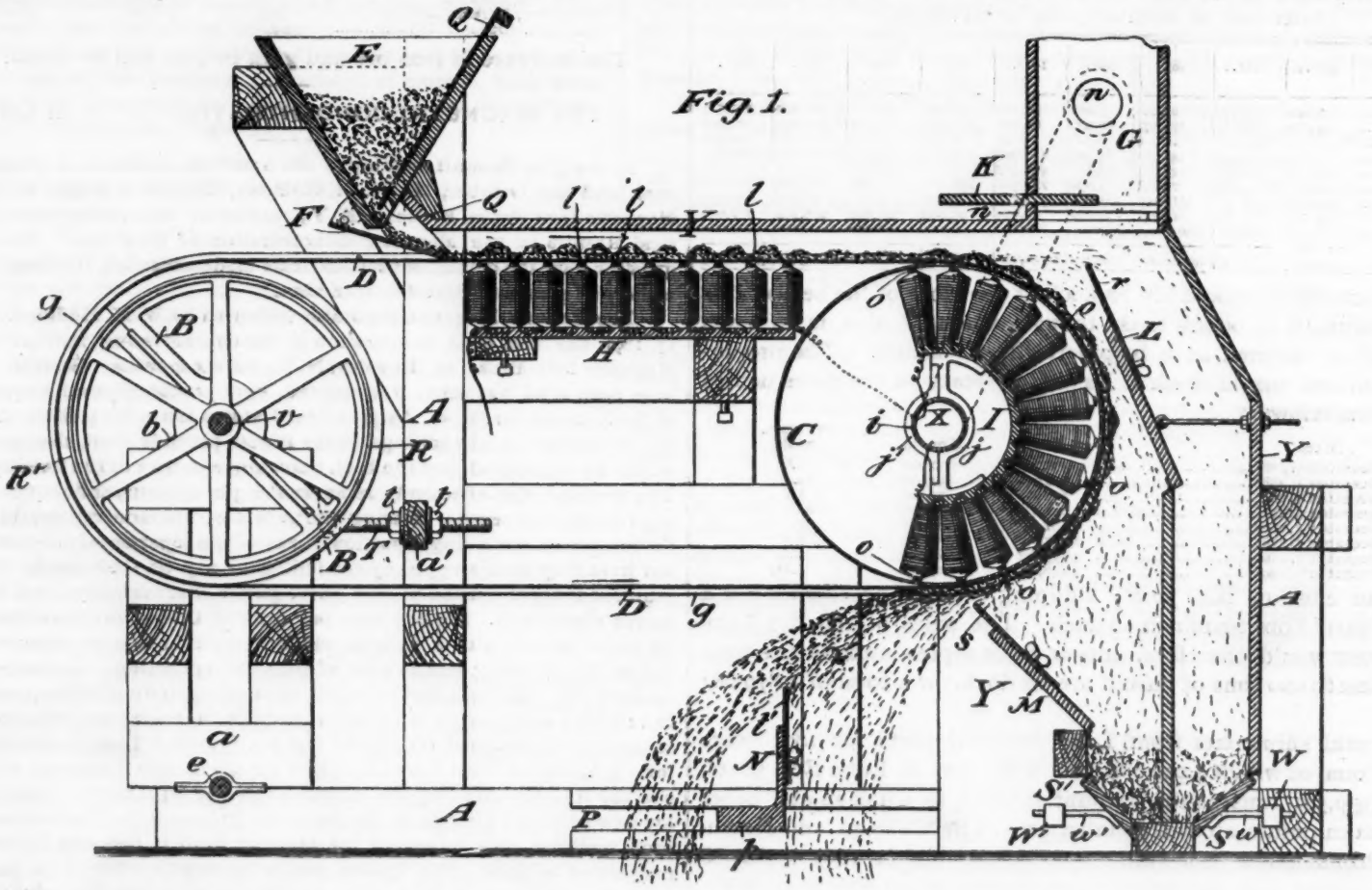


FIG. 2.

The magnetic particles having been arranged by the preparatory magnet H into a stratum in proximity to the surface of the belt, it becomes feasible to employ a magnetic force sufficiently strong to act upon the entire stratum of partially-separated magnetic particles. The non-magnetic and lighter particles forming the upper stratum will, under the horizontal motion imparted to them by the belt, leave the magnetic stratum in a trajectory as the belt begins to follow around the periphery of the drum C, and will be assisted in separating itself from the magnetic stratum by the lifting and wedging action of the upward current of air following along between the periphery of the drum C and the upper portion of the partition L. Just what part of the upper stratum shall be allowed to finally escape and be permanently separated from the lower stratum is determined by means of the partition L and its sliding section *r*. Such portion as passes over the section *r* falls to the base of the space between the casing Y and the partition L, and as it accumulates in a sufficient quantity automatically opens the gate S and escapes. The magnetic stratum follows the path of the belt D around the periphery of the drum C by reason of the attraction to the magnet I and its wave-like motion is continued, constantly gathering the more highly-magnetic particles closer to the poles and consequently to the belt D. This wave-like motion also continues to expel to the surface all the slightly-magnetic substances which gradually fly from the surface under the centrifugal force, and as the mass passes the transverse horizontal axis of the cylinder, being aided by the force of gravity. During its passage around the periphery of the drum C a scouring action is kept up upon the surface of the mass by the opposing current of air and by the agitation of the mass, which effectually brings all of the particles into contact with the air-current. The intensity of the air-current may be regulated by the speed of the exhauster and by the adjustments of the several slides in the partitions. The slightly-magnetic particles, together with such non-magnetic particles as were not at first separated from the mass, fall from the surface of the belt into the space between the partitions L and M, and as they accumulate in sufficient quantities are automatically discharged through the gate S'. After passing the partition M the less magnetic material continues first to fall from the belt, while the more-magnetic is still carried forward and finally leaves the belt after the latter has carried it beyond the holding force of the last pole of the magnet I. The adjustable partition N serves to separate this last mass of material as it falls from the belt, so as to retain a pre-determined percentage of purity in that portion which is the most magnetic.

Fig. 1.



COAL AND ORE HANDLING MACHINERY.

The tendency of machinery for unloading vessels and for handling coal, iron ore and similar materials, has been towards more rapid work, and at a less expense per ton, necessarily requiring machinery that is heavier, more complex and more expensive. The change from doing the work almost entirely by hand to the present method of doing the work wholly by machinery has been a gradual one. The first method required a great amount of hard physical labor. The present method requires but little exertion on the part of workmen, but requires more skill, entails greater responsibility, and a higher rate of wages per day.

The advances from the primitive method of handling, by means of baskets, through the various processes of wheeling, hoisting by horse-power, etc., had not been very rapid until the introduction of automatic machinery, one of the most efficient types of which is the Hunt Automatic Railway. This railway is operated entirely by gravity needing neither steam, horse nor manual power. The car runs down the track, dumps the load, and returns to the loading place automatically. The workman does not accompany the car, and has ample time, while the car is making the trip, to weigh the coal and enter it in his weight-book. With one man only, the coal can be weighed and stored in any desired bin within 500 or 600 feet of the vessel. As the carrying capacity of this car is over 60 tons per hour, the number of shovelers in the hold of the vessel was increased to three, and the coal was hoisted by a small steam engine. The output now was about 15 tons per hour, or 150 tons per day, with a total of five men employed; three shovelers, one hoister and one attending the automatic car, or an average of about 25 to 30 tons per day for each man employed.

The increase in the speed of handling by the use of the steam engine and the automatic car, made the swinging of the bucket, as it came out of the hold, whether using an ordinary gaff or hoisting from a sling from the mast head, very objectionable. This was overcome by the use of the "Hunt elevator," which had inclined booms running out over the vessel, the bucket being hoisted vertically until it reached the booms, and then guided by a track up to the point desired. The output per day with this machine was about thirty-five or forty tons per day for each man employed.

To reduce the expense of shoveling, and at the same time to increase the daily output, the manufacturers devised a steam shovel, which fills itself when lowered on the coal, and carries from 1 to 1½ tons to a load. It is entirely automatic, both in filling and in dumping, so that no one is required on the vessel in any way, except toward the last to scrape the coal out of the corners. As this shovel and its load weigh about 6,000 pounds, a very great increase in the size of the hoisting engine was necessary, and to the power of these massive engines has been added a specially designed governor, by means of which changes of speed can be made entirely independent of the throttle valve, or the engineer.

The shovel carries over a ton of coal at each trip, and will make a round trip in about forty five seconds, but the average speed of unloading in discharging cargoes is from fifty to seventy tons per hour at each hatch, with one man on the vessel, one at the engine to hoist and one to attend the automatic car, making a total of three men who take out from five hundred to seven hundred tons per day, or from one hundred and sixty to two hundred and thirty tons per day for each man employed at the work; thus the efficiency of one man's work has been increased, by the use of modern machinery, from three to over two hundred tons per day of ten hours, or in the proportion of about seventy to one, and the increase since 1873, when Mr. Hunt began the introduction of his automatic machinery, has been about twenty to one, and at the same time the physical exertion of the laborer is much less severe, and the wages paid to the workmen per day nearly fifty per cent. greater. The automatic railway answers the purpose of conveying coal for distances of 600 feet or less, but beyond that a different method is necessary. For this purpose a cable railway is used in which the cars are drawn by a wire cable running the whole length of the track and driven by power.

From a host of illustrations showing the applications of this system, we select a few as being of more especial interest to our readers. Further particulars can be obtained by addressing the C. W. Hunt Co., 45 Broadway, New York.

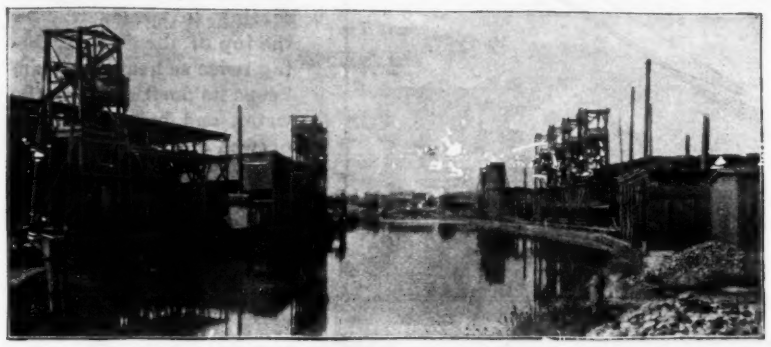


FIG. 1—Coal Handling Machinery in Milwaukee, Wis. H. M. Benjamin, Pennsylvania Coal Co., and R. P. Elmore Co.

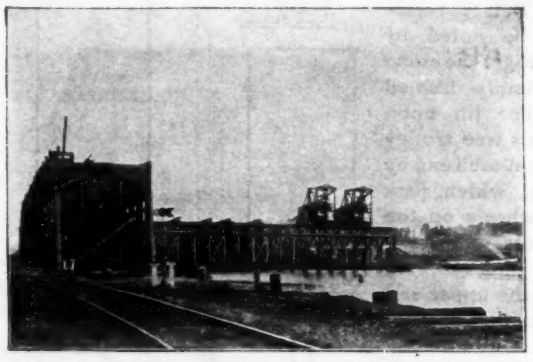


FIG. 4—Columbus & Hocking Coal & Iron Co., Manitowoc, Wis. Four Movable Elevators, Automatic Railways and Pockets for Coaling Locomotives.

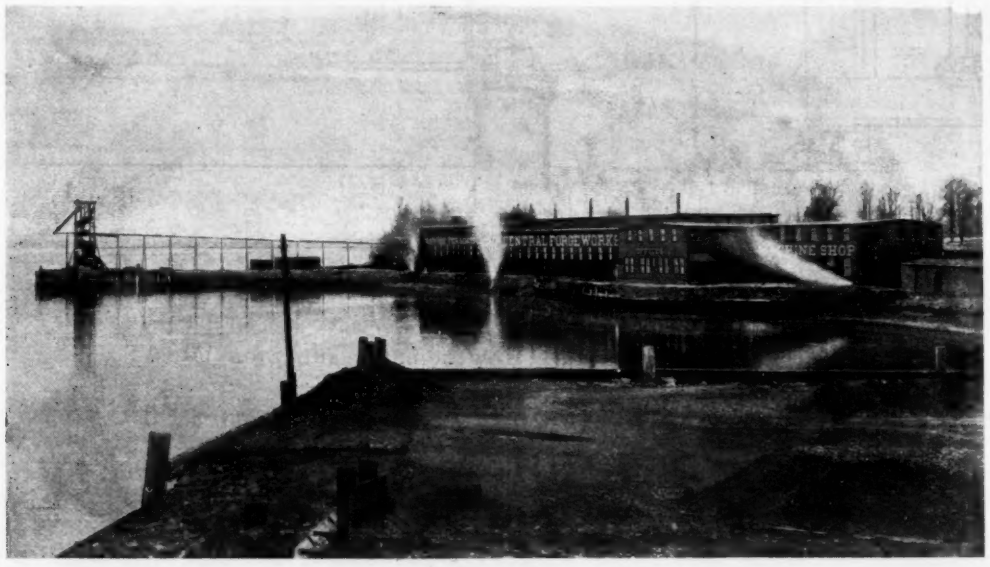


FIG. 2.—Central Forge Works, Whitestone, N. Y.

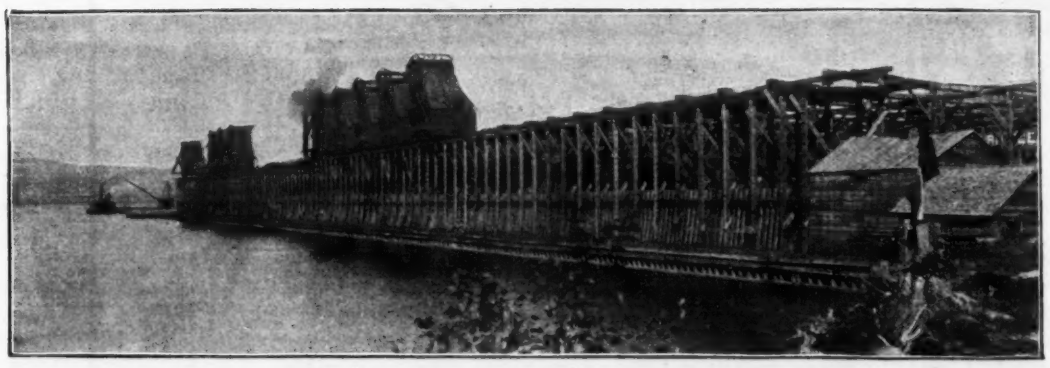


FIG. 3—Lehigh Coal & Iron Co., West Superior, Wis. Fitted with Hunt Machinery, wharf 2,000 ft. long, 300 ft. wide. Nine Elevators and 75 Automatic Railways—Capacity for unloading from vessels, 7,000 tons per day.

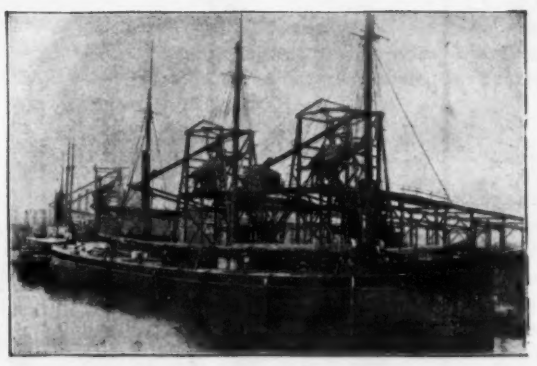


FIG. 5—Joliet Steel Co., Chicago, Ill. Six Elevators and Automatic Railways for handling Iron Ore.

STEAM HYDRAULIC BALANCED CRANES.

Probably no machine ever leaped so quickly into public favor as the Ridgway steam hydraulic system of cranes, elevators and kindred machines. As these valuable machines are now attracting more than usual attention among those who have to handle heavy weights we devote considerable space to lay them before our readers. The accompanying cuts show one of the many styles of cranes which are built upon this system. Fig. 1 is an outline cut of a crane such as is made for low buildings. Fig. 2 shows the same style of crane as in use in the new foundry of the Diamond State Iron Co., Wilmington, Del.

As will be noted by reference to Fig. 1 the crane is a very simply framed structure. The jib upon which travels a free trolley is suspended at each end by short chains, which pass over chain wheels on the inclined braces and mast, and thence under chain wheels upon the upper end of a large cylinder, and are fastened to the bracket upon the mast. By this arrangement it will be seen that the weight of the jib and that of the cylinder are made to counterbalance each other about the mast, and the weights of these two heavy numbers are also concentrated at the pulleys on mast some little distance back of it, and so they counterbalance the weight of the inclined braces. The crane, in consequence, is in entire balance. A five-ton crane of this type with a two-ton load hanging upon it produces no greater strain upon top supports than other five-ton cranes do when not loaded at all. The piston rod of the cylinder is hollow. It is attached to a projection of the bottom gudgeon, and a pipe leads from this gudgeon through a suitable packing box in the center of the mast, and thence through the foundation plate to the outside of the crane. The distinguishing feature of this system of cranes is the manner in which they are operated, and which is called by the builder "steam hydraulic."

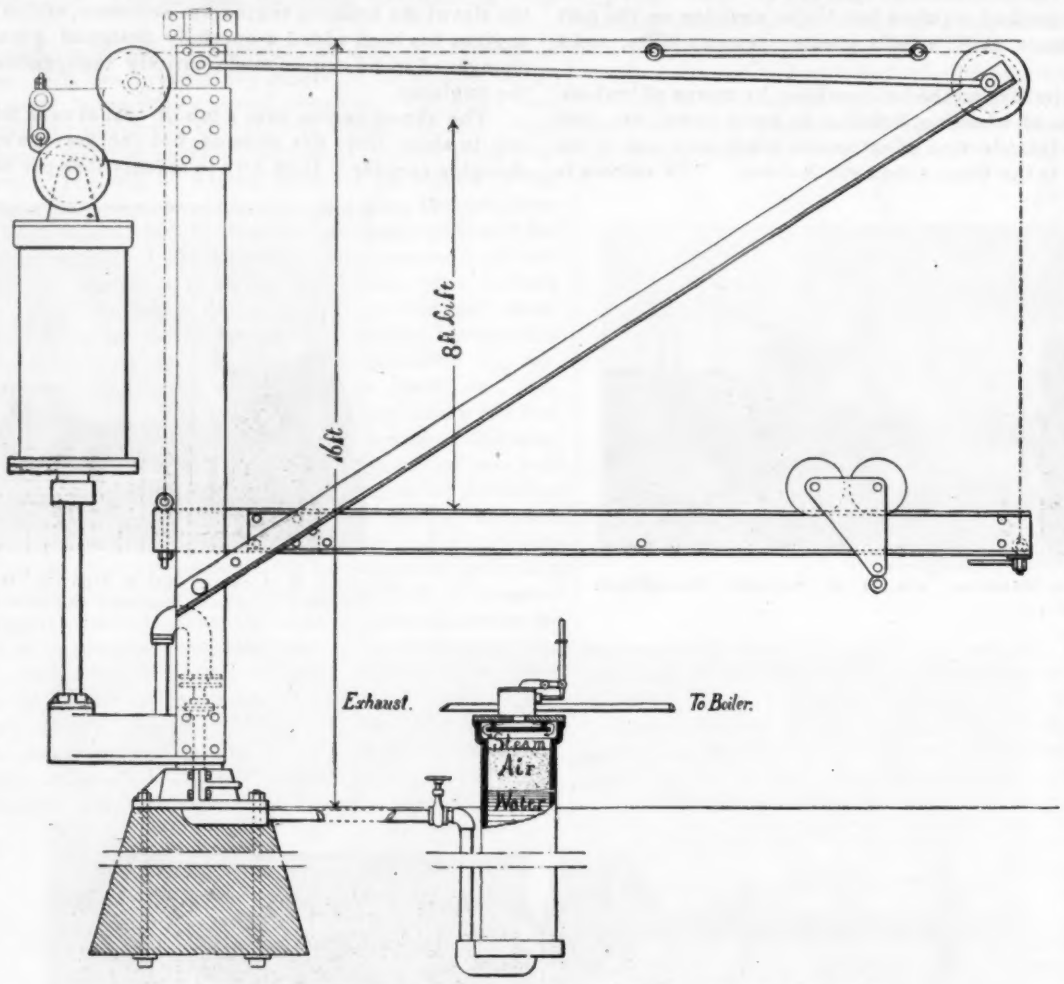


FIG. 1.—RIDGWAY CRANE FOR LOW BUILDING AND HIGH LIFTS.

The crane is a true hydraulic crane, but no pumps or accumulators are used. The direct steam pressure of the boilers is used in the following manner. In the ground at any convenient point, no matter where, is placed a closed cylinder. From the bottom of this ground cylinder a pipe extends to the crane as shown in Fig. 1. On top of this cylinder is placed a plain D slide valve. A pipe leads from this valve to the boiler. This ground cylinder is filled with water to within a foot or 18 inches of the top, air filling the remaining space. It now being desired to lift the crane, steam is admitted to the ground cylinder, seemingly on top of the water. But—and here is the secret of the success of this machine—the steam does not come in contact with the water at all, but passes in on top of the body of air that is over the water; a baffle plate serving to spread it over the top of the air. Air being twice as heavy as steam keeps its position next the water, and being almost a perfect non-conductor of heat, there is but slight condensation of the steam. When the steam is admitted to this ground cylinder it becomes at once an accumulator, as it were, carrying a pressure equal to the boiler pressure. The water is then forced to the crane with this boiler pressure, and entering the cylinder on the crane it is forced down its rod and the load lifted. To lower the load, steam is exhausted, and the water flows back to the ground cylinder by gravity. The same water is used over and over again indefinitely. To prevent its freezing in severe climates a small proportion of glycerine is added to it. Some who have the cranes use other mixtures. At the Pencoyd Iron Works coal oil is used. As the steam pressure carried at most works is rarely over 100 pounds and often much less, the crane obtains its lifting capacity by using a cylinder of large diameter in contradistinction to the usual hydraulic cranes which carrying a high pressure use only a small ram. But, as in this crane the weight of the cylinder is made to perform the function of a counter balance, its large size is an advantage.

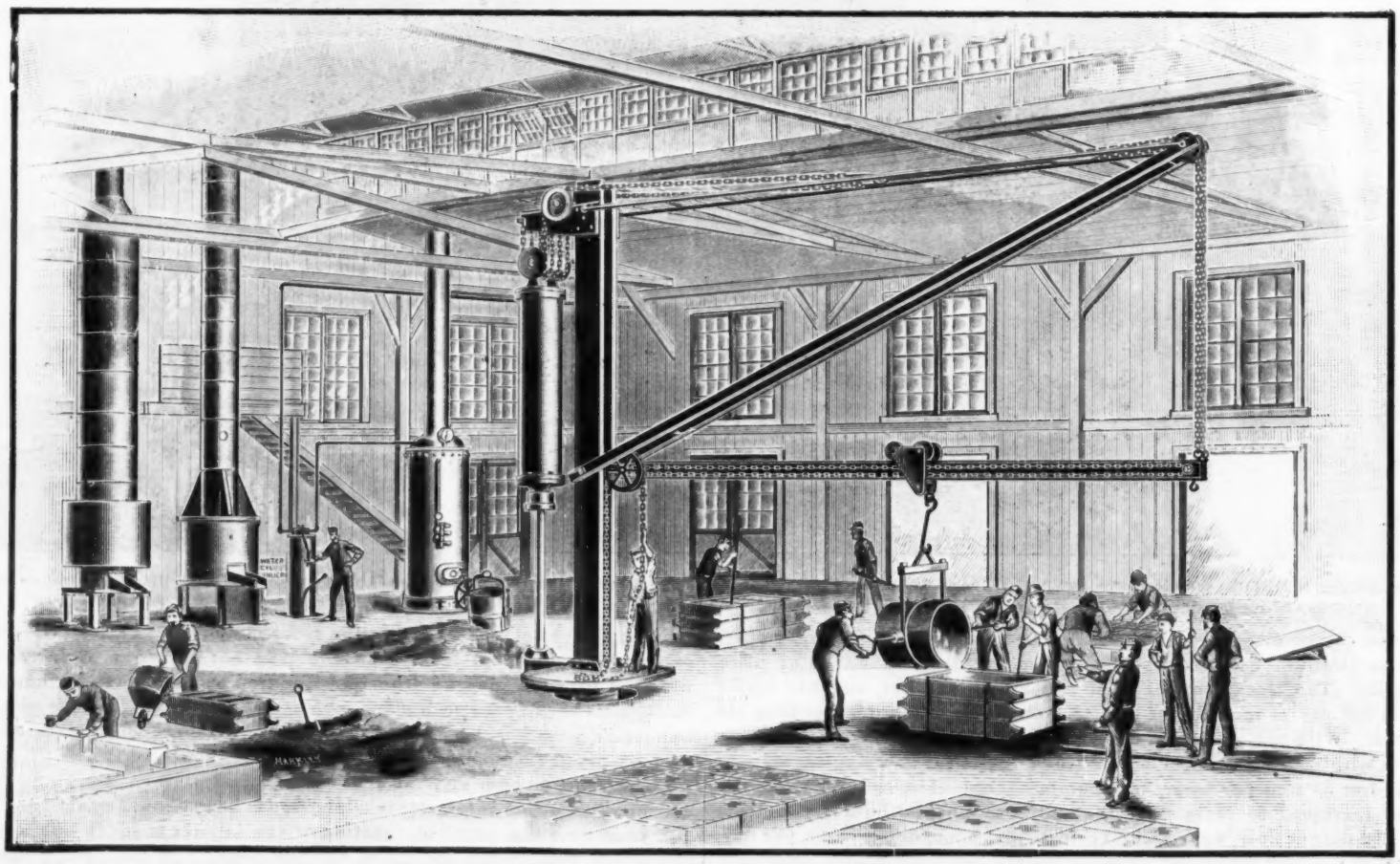


FIG. 2.—RIDGWAY CRANE IN FOUNDRY SERVICE.

We think those of our readers, who have followed the description of this crane this far, can not but be impressed with its merit. All pumps and

accumulators are done away. There are no pipes and valves to keep up under heavy and destructive pressures and shocks. The water having an elastic body of steam back of it, the motion of the cranes is remarkably smooth and uniform and there is no likelihood of the crane getting out of order. At the Passaic Rolling Mill Co., Paterson, N. J., one of these cranes, similar to the cuts, has been at work day and night for a year and a half handling ingots, and in all that time it has never been necessary to even touch it or give it the least attention.

This crane is found particularly desirable for foundry duty and a large number are in use in the best foundries in the land. Any one can operate the crane for no matter how careless, men can not injure themselves, the work, or the machine. The sudden dropping of the load with full head of steam on, or the throwing on of full steam with no load, makes no difference as the crane always keeps the same even and uniform speed, empty or loaded. This speed is regulated by a valve in the pipe between the ground cylinder and crane. This steam hydraulic system is used for elevators as well as for cranes, and they are in use for taking stock up to cupola and furnace platforms.

As we stated at the beginning of this article, this crane has become immensely popular, and is preferred to the ordinary hydraulic system, by many who already have an hydraulic installation. The hydraulic with its constant danger of freezing up and the continual bother with valves, pipes and packing is every day getting more and more into bad repute, and mill men are glad for anything that promises them relief from this annoyance. The National Tube Works Co. are equipping their immense plant at McKeesport with these cranes, having eight of them in a single room, where they are used for changing rolls, handling goods and other purposes.

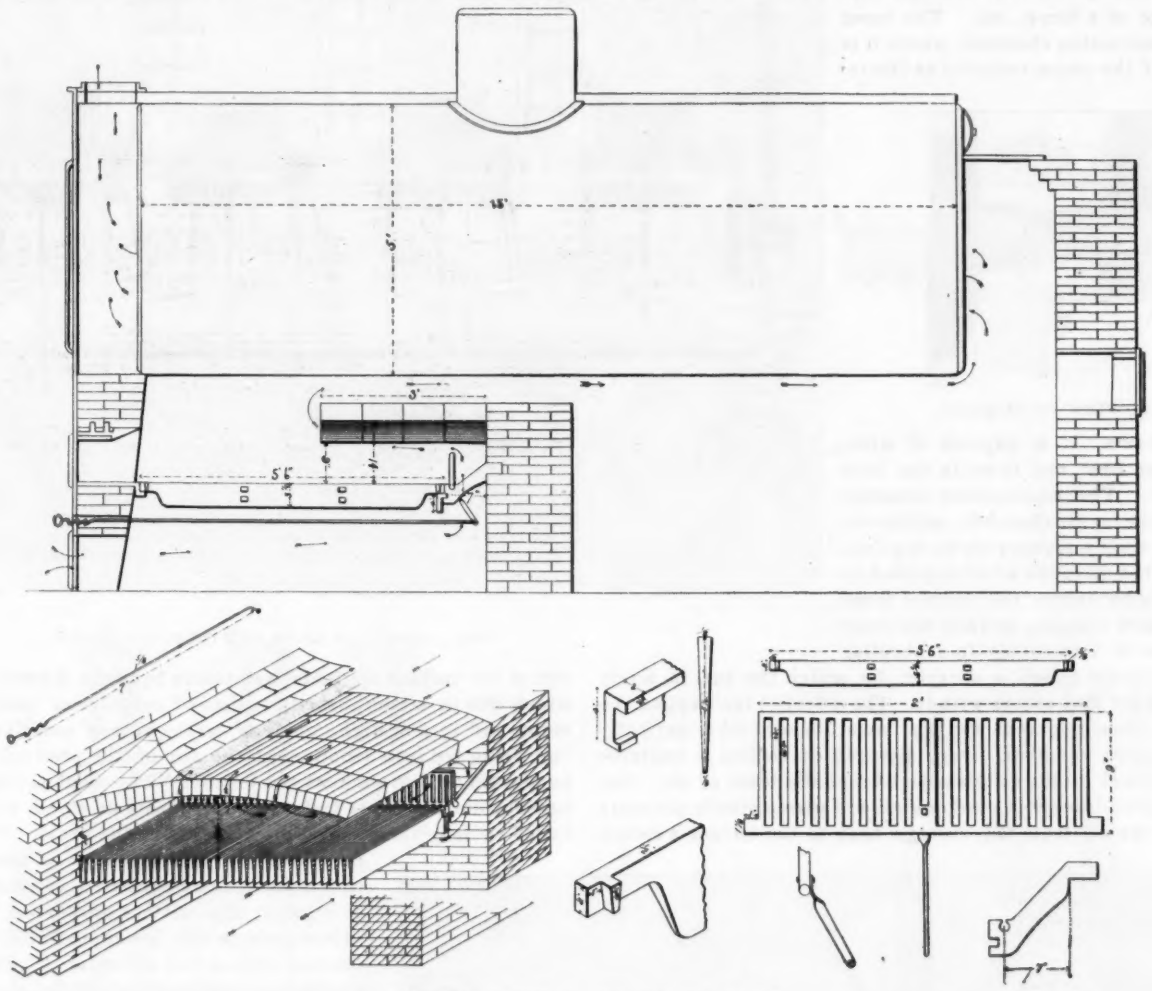
To establishments having no hydraulic plant and wishing to save in the cost of moving materials by hand, this crane is adapted. It is cheap, easily erected and easy on top supports on account of its balanced feature. To put it to work, it only requires a connection to the existing steam supply. The steam hydraulic system as well as the cranes and elevators used with it, are the invention of Wm. H. Ridgway, M. E., and they are manufactured by Craig, Ridgway & Son, Coatesville, Pa., who should be addressed for circulars by all those interested in the machine.

Advising a Furnace Shut-down.

Quite a large tonnage of Bessemer pig metal has been contracted for, for delivery during the first quarter of 1892; this and the contracts for December delivery will keep a fair percentage of the furnaces busy and hold them out of the markets until about February, when the managers of them will begin to get uneasy again about the Spring trade. In the meantime the furnaces that have not sold up, as well as those that have been holding their product for better prices, will have to continue living on hope and watch their chances. The wisest policy would be to dampen down and await developments, as the continuance in active operation will be only keeping up the overplus and postponing the advent of any possible chance for a reaction. It strikes me that it will also be much more agreeable to pull out voluntarily, than it would be withdraw under compulsion, and there is no use of ignoring the fact, that the present output is excessive, "when a man must, he'd better," and to modify this, when a man had better, he'd ought to.—["Cold Short," in Ohio Valley Manufacturer.

BACKUS' CENTRAL DRAFT FURNACE.

A newly designed furnace of much interest to manufacturers is illustrated herewith. The cut so clearly shows the construction of the furnace and the mode of its operation, that no extended description is necessary. The inventor, Mr. A. Backus, Jr., of Detroit, informs us, that a careful test has been made with this furnace, coal and ash being carefully weighed, and the result was a saving of 20 per cent. in economy. He claims that it is a complete cure for the smoke nuisance. It is manufactured by the Backus Co., 505 Fort street West, Detroit, Mich., who gives the following instructions for the proper managment of the furnace: "To start a fire in this furnace, spread a thin layer of coal over the entire grate surface and ignite the same at the rear, under the arch, next to the shield. Be careful to keep the entire grate surface covered, this will insure prompt, quick work and abundant steam and will consume the smoke. If slack coal is used, a barn shovel is preferable to a scoop shovel.



BACKUS' CENTRAL DRAFT FURNACE.

Coal should be spread thin and even and about two inches in depth, and never to exceed three inches on the grate. The fireman should understand that a large amount of coal at one time produces the same result as closing the venilating doors, which banks his fire, creates clinkers and wastes his fuel. This furnace steams readily and shows a large economy in fuel, is nearly smokeless and applicable to all horizontal boilers."

American-Built from Stem to Stern.

One of the pleasantest facts published in regard to the gigantic new cruiser, "New York," launched from Cramp's yards, last week, is this, that the requirements of the contract are that it "must be constructed of steel of domestic manufacture, and be provided and fitted with machinery, engines, and boilers, also of domestic manufacture, complete in all their parts," and that these conditions have been carried out to the letter. The "New York" is, therefore, a typical American vessel, hull, plates, engines, boilers, guns and all.

Another provision of the contract was that the vessel must not make less than an average speed of twenty knots, maintained for four consecutive hours successfully. Keeping in view the great power required to drive a vessel of her size at the high speed of twenty knots, the Bureau of Steam Engineering, in designing the propelling machinery, thought it advisable to divide up this power in four parts. For this reason two engines of about 4,000 horse-power each will be placed on each twin-screw shaft. These engines may, by means of an easily worked coupling, be readily disconnected from each other, which enables the ship when cruising at low speed to be driven by the after set of engines only. Hence there will be no difficulty in economizing in fuel at times of ordinary cruising. There will be four propelling engines, of the vertical, inverted, direct-acting, triple-expansion type, the collective horse-power of which will be 16,000 when the main engines are making 129 revolutions a minute. For every quarter of a knot above the guaranteed speed of twenty knots which the vessel may make a premium of $50,000 will be allowed to the builders, and for each quarter of a knot she shall fail of reaching the guaranteed speed a penalty of $50,000 will be deducted from the contract of price of $2,985,000. The Navy Department is confident that it has attained in the "New York" an unusual combination of great offensive and defensive power, with extraordinary coal endurance and a high rate of speed.

FUEL GAS PROGRESS.

THE "STANDARD" HYDRO-CARBON BURNER.

The Standard Oil Fuel Burner Co.'s hydro-carbon burner (Myers' patent), which has been in use in some of the largest manufactories in the country during the past three years, has fully demonstrated the practicability and economy of the use of crude petroleum as a fuel for forging and welding iron and steel, melting metals and numerous other purposes.

The burner is a simple piece of mechanism, very easily adjusted, and, with ordinary care, will seldom get out of repair. In the illustration shown, Fig. 1, it will be seen that it is devoid of all complications. The outer and exposed portion of the burner is a casting, with a flanged edge for easy attachment to the front plate of a furnace, the back plate of a forge, etc. The inner casing of the shell or combustion chamber, where it is exposed to the heat, is of the same material as the refractory brick used in retorts. It is capable of withstanding the most intense heat, and is set in the iron in a substantial manner. The combustion chamber opens at the rear end into an air chamber, which can be closed with a slide in such a manner as to regulate with the greatest nicety, the quantity of air supplied to the flame. The supply pipe enters the burner from the rear and extends a short distance toward the combustion chamber, where it terminates in a peculiar fimbriated device, technically called a sprayer, by which the fuel is finely dived and mixed with the air that enters with it. The effect of the oxygen the air brings with it is at once apparent on the flame, the oil fuel is perfectly consumed in the combustion chamber, every particle of carbon it contains being turned to good account in the continuous but gentle blast of air. For air pressure the ordinary fan-blower is used, which will give a steady pressure of six ounces. To carry the oil from the storage tank to the burner a rotary pump is used. The piping should be so arranged that the surplus oil will flow back to the storage tank, which can be placed to suit the convenience of the works.

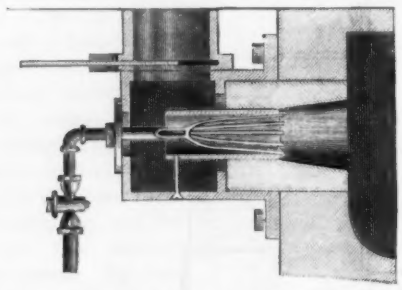


FIG. 1.—SECTIONAL VIEW OF BURNER.

Among the purposes for which the burner is adapted are: all kinds of iron and steel forging, tempering welding, annealing, etc.; for brass, mining, chemical, brick, lime-kiln, glass, gas and barrel works; for burning sewer-pipe, heating asphalt, tinning japanning, oxidizing lead, etc.; for generating steam and for an endless variety of special work. Fig. 2 shows the general arrangement of the plant, and Fig. 3 a section of a plant of fifty fires put in for the Lamson & Sessions Co., Cleveland. The Standard Oil Fuel Burner Co., Fort Plain, N. Y., are the manufacturers.

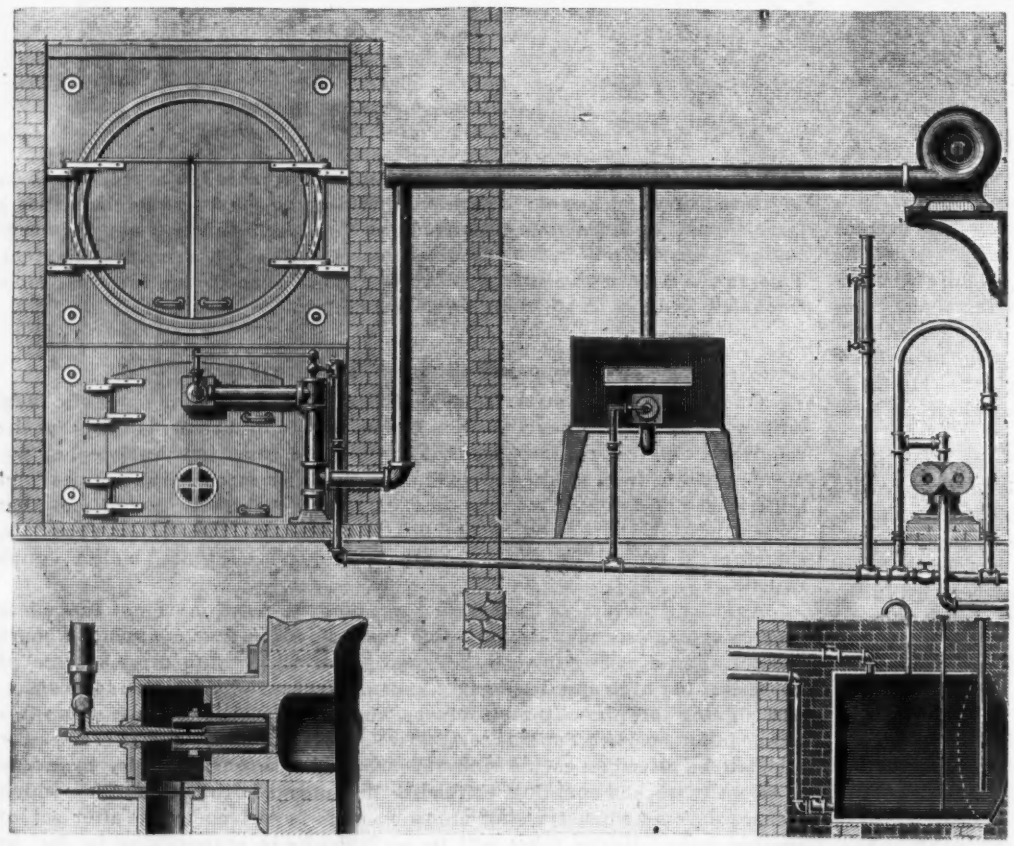


FIG. 2.—GENERAL PLAN OF TANK, PUMP, BLOWER, PIPING AND BOILER SUPPLY.

Dr. Hennin's Process.

The improvements effected by Dr. Alphonse Hennin in the manufacture of fuel gas are claimed to result in an article containing as high as 60 per cent. of combustible matter, and at the same time obtaining larger quantities of ammonia and tar per ton of coal used than have ever before been secured by any of the various methods heretofore brought forward. The apparatus by which this is accomplished consists of cylindrical producers, 10 feet in diameter and 15 feet high, made of wrought iron and lined with fire brick, the fuel being fed into a hopper at the top of the producer, and the bed of fire supported on a grate near the bottom. The combustion which generates the heat for distillation is maintained by blasts of steam and air, which are introduced radially through tuyeres just above the grate. The peculiar advantage possessed by this method, as compared with all others which have been proposed, consists in its adaptation to so regulate the relative proportion of steam and air as to maintain in this lower portion of the producer an incandescent zone or bed of fuel at a sufficient temperature to decompose practically all of the steam admitted. At the same time this is effected the supply of fresh fuel is so regulated that the upper portion of the producer is kept at a temperature sufficiently low to allow the formation of ammonia and prevent its decomposition.

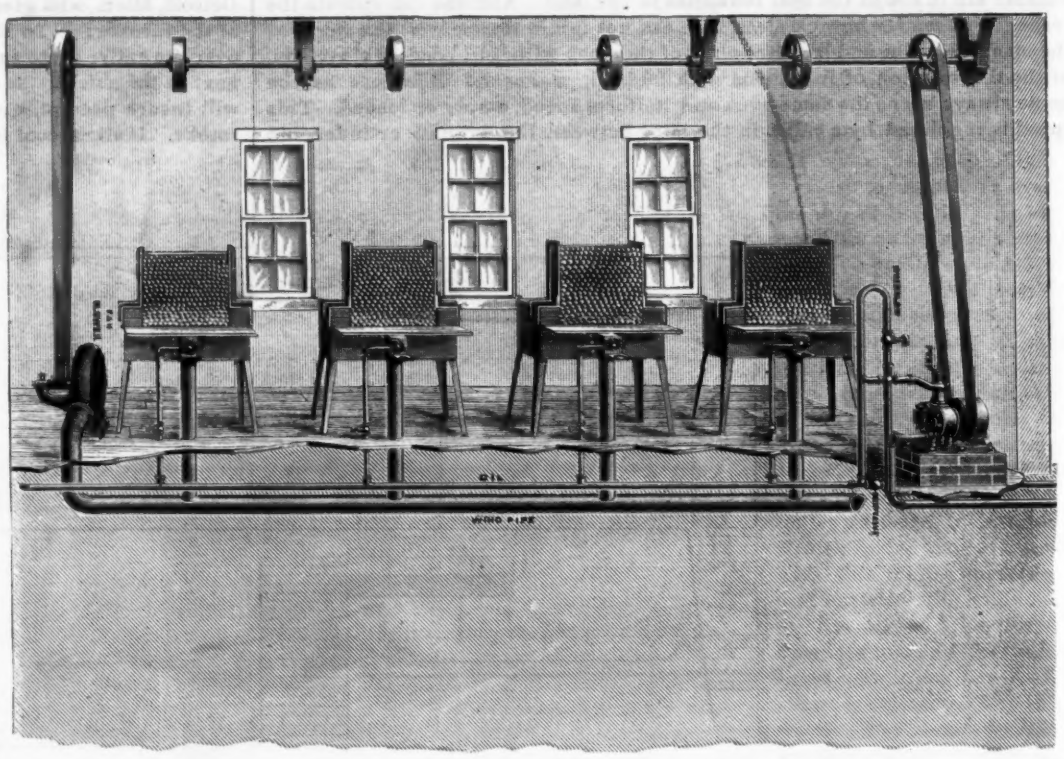


FIG 3.—SECTION OF PLANT OF FIFTY FIRES.

Petroleum as Fuel in Lowell.

Accounts from Lowell state that the Tremont and Suffolk mills, Lowell, Mass, have made a practical success in using petroleum as fuel, and the estimate is made that a pound of the petroleum is equal to 18 pounds of coal. The mill uses the petroleum in the form of gas. The plant includes two tanks, which are buried in the ground about 30 feet from the furnaces, thus insuring safety from fire. A smaller tank is located above the larger ones and the contents of the latter are pumped into it. This small tank contains the supply for immediate consumption. A series of pipes runs from here to the boilers, which are situated on a lower level.

The arrangement of the oil reservoir in relation to the boilers is perfectly safe. The level of the two large tanks is below that of the boilers, so in case the regulators fail to act and cause the tanks to burst, no serious results would follow so far as fire is concerned. The upper tank is so small that its contents would soak into the ground before they reached the boilers.

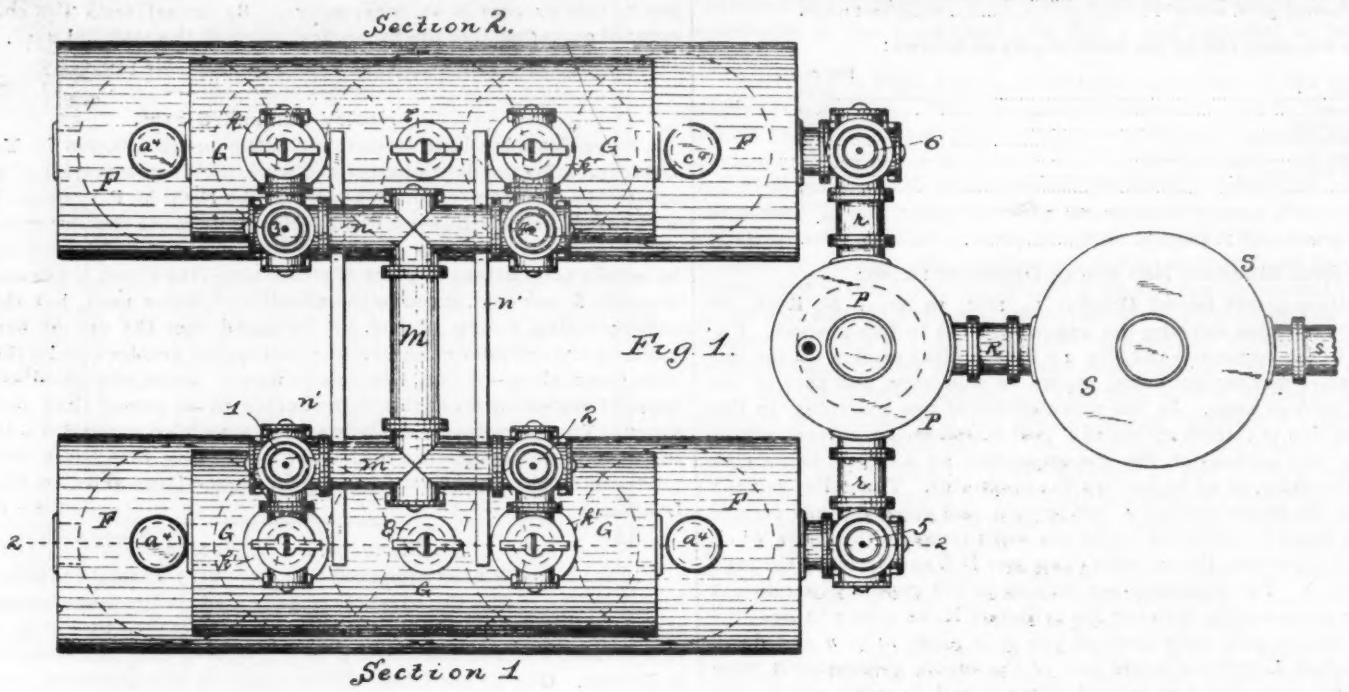
The oil flows from this reservoir through the pipes to the burners under the boilers. These devices consume the oil in the form of spray mixed with steam. Perfect combustion is produced and no soot or smoke is caused, yet volumes of black smoke pour out of the chimneys surrounding the Tremont and Suffolk mills, while not the slightest trace of smoke can be seen issuing from its own. The fire is regulated by simply turning a valve, thus it is under the immediate control of the firemen, and it is an easy matter to keep the steam at a uniform point. The mills used eight boilers before they introduced petroleum. To-day they are using but six, and yet the speed of the two powerful engines is the same, and have just as much work to do as before. The neatness of the fire-room in consequence of there being no coal or ashes is an important point. The experiment has not been underway long enough to

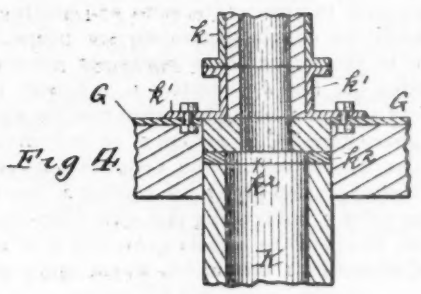
permit an estimation of the difference between the cost of oil and coal as fuel, but it is supposed that the difference is small. The oil is brought to the mills in tank cars containing from 3,500 to 6,000 gallons each.—[Heat, Light and Power.

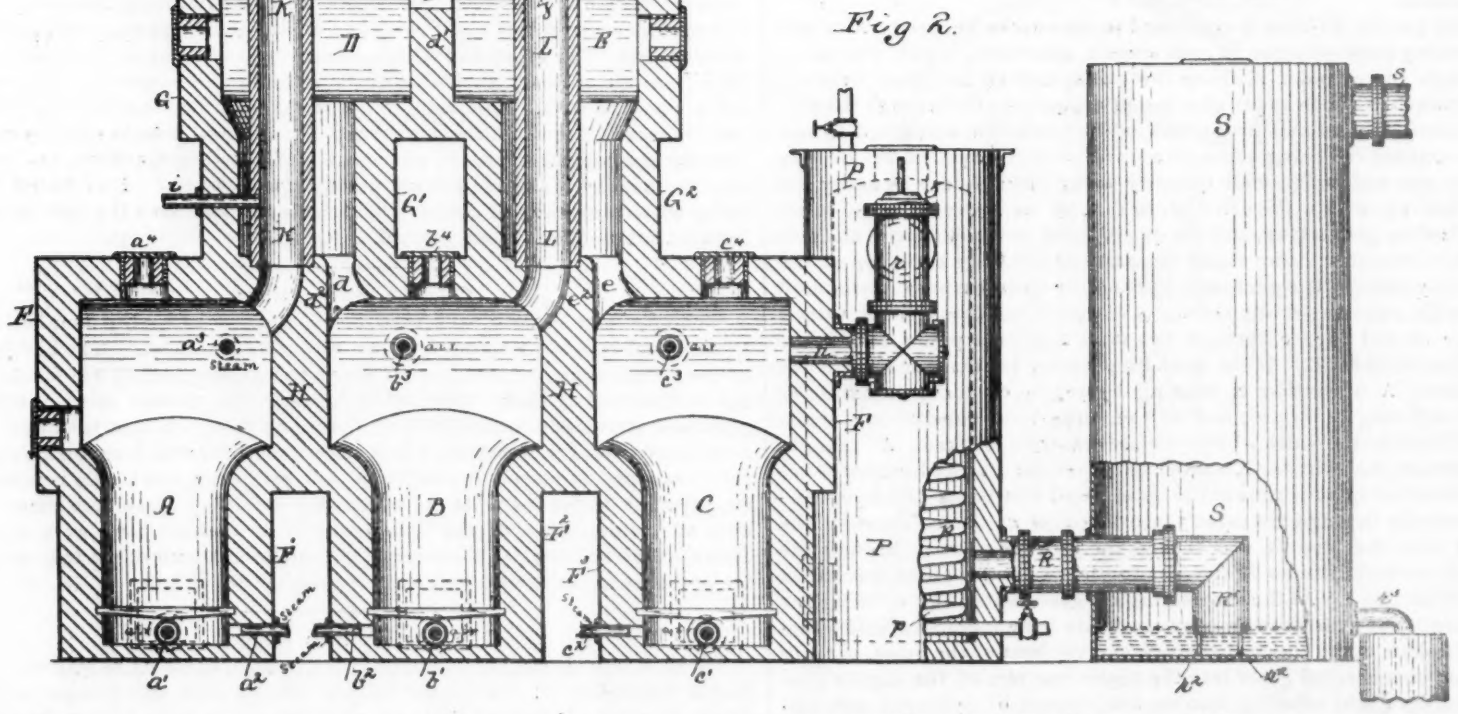
RECENT PRACTICAL TESTS IN LARGE IRON WORKS.

The National Heat & Power Co.'s gas process is in continuous use at the Bellefonte Iron & Nail Co.'s mill, Bellefonte, Pa., puddling iron, and is claimed to be doing so at a less cost than with coal, and producing much better iron. It is also in use at Cornwall & Colebrook furnaces, roasting ore for Mr. Robert H. Coleman. The National Co. is about finishing a plant for Messrs. Carnegie, Phipps & Co., Limited, Pittsburgh, Pa., for use in puddling and heating furnaces, and is building plants for Braddock and West Chester, Pa., for making illuminating gas. Of this system Mr. J B Gray, the Manager of the National Heat & Power Co., 419 Walnut street, Philadelphia, writes us:

"Ours is the first system of fuel gas that has succeeded in puddling iron practically. We are only using 20,000 feet of gas to the ton of finished iron. As our gas can be produced for five cents per thousand cubic feet at Pittsburgh, and it costs $1 65 per ton for the coal to puddle a ton there, we are going to effect a great saving for the iron manufacturers. Carnegie, Phipps & Co sent an engineer to our Bellefonte plant to make a report on it, and kept him there five weeks, and had daily reports from him. From careful tests he reported that this gas cost 6⅔ cents per thousand feet with coal $1.56 and coke $2.25 per ton, and oil at 2¼ cents per gallon. They have secured the right to use our process in all their mills, and we expect to have their plant in operation within thirty days. Heating is a simple matter as compared with puddling, and we will have no trouble in doing it economically. Our gas is fixed and burns in the open air similar to natural gas, and requires no regeneration. We find, however, that there is great economy in regenerating the air, and are doing so in our Bellefonte puddling furnace. The fuel gas is from 10 to 12 candle power, and developed 11 candle-power to the foot, burning in Welsbach burners, the test being made on a regular photometer bar with candle balance. While our actual heat units are only 470 to 800 to 900 contained in natural gas, in tests in evaporating water we get nearly as many available heat units as from natural gas. This is partly caused by our gas requiring less air for perfect combustion, and partly by its greater luminosity. We wash and scrub and purify it and deliver it into a holder and thence through underground pipes. The process of manufacture is very simple, and does not require skilled labor. We use bituminous slack, coke and Lima oil, about 18 pounds solid material and 1½ gallons of Lima oil to the thousand feet for fuel gas, and add 1½ gallons of Lima oil to the thousand feet to make illuminating gas. The same apparatus is used for both kinds of gas and a change from one to the other requires no preparation, and can be done at will. The only thing in motion is a small positive blower used to supply air to the combustion chambers. The oil is injected in a fine spray in connection with superheated steam. The steam is heated without cost by the hot gas passing through a coil of steam pipe. A plant with a capacity of 50,000 feet per hour can be erected for about $9,000, not including the holder. We can supply glass works, potteries, brick manufacturers and all iron manufacturers with a sub-







stitute for natural gas or coal, and do their work better and as cheaply or cheaper than they are now having it done except where they have a supply of natural gas that they can get without passing it through meters."

Prof. E. G. Love, Chemist of the New York Gas Commission, gives the following analysis of this gas (illuminating):

	Per cent.
Hydrogen	39.01
Marsh gas	24.32
Carbonic oxide	9.90
Heavy hydrocarbons	12.48
Nitrogen	12.32
Carbonic acid	None
Oxygen	1 57
	100.00
Specific gravity (air 1)	0 580
Calorific power (30 in. and 60° F.)	615.29 heat units.

The fuel gas was analyzed by the same expert as follows:

	Per cent.
Hydrogen	44.67
Marsh gas	14.50
Carbonic oxide	15 35
Heavy hydrocarbons	5.30
Nitrogen	18.83
Carbonic acid, etc	None
Oxygen	1.35
	100.
Calorific power at 60° F. and 30"	470.05 units.

Gas shipped from Bellefonte Nail Works, December 11, 1890.

From the letters-patent issued October 13, 1891, to Mr. J. M. Rose, we reproduce two illustrations showing the apparatus used in this process. Fig. 1 is a plain view of the apparatus and Fig. 2 a longitudinal section on the line 2 2 (Fig. 1), the valve mechanism being shown in side view, and part of the apparatus being broken away. In the manufacture of gas according to this improved process, fire is started within and coal is fed to the several cupola generators of the two sections of the gas apparatus, an air-blast being continued through the same, so as to heat up the apparatus. The relief-valves 7 and 8, controlling the escape-outlets *h*, are opened and generator gas formed in the generators B and C, air being fed to the same through the inlets b^3 c^3, and the gases burning within the cylinder-chambers D E and escaping through the outlet-passages *h*. The generator-gas formed in the cupola generators A of each section pass upwardly through the cylinders K, so acting to heat the same, and they thence pass over through the side pipes *m* or *n* and down through the cylinders L into the upper part of the cupola generators B, commingling with the generator-gas formed therein and burning within the cylinder-chamber D to assist in heating the same and heating the cylinders K. This is continued until the cupola generators are properly filled and the apparatus is brought to the proper heat ready for gas-making, when the relief-valve 8, controlling the flue *h* of section 1, is closed, the relief-valve 7, controlling the flue *h* of section 2, being left open and the air-blast being continued to the cupola generators B C of section 2, so as to maintain the heat in said section. The valve 4, controlling the cylinder L of section 2, and the valve 6, controlling the education-pipe *r* of section 2, are then closed, the valves 1, 2, 3, and the valve 5, controlling the education-pipe *r* of section 1, being opened. The air blasts to the cupola generator A of section 2 and the cupola generators B C of section 1 are cut off, steam being fed to said several cupola generators.

In making gas the air-blast is continued to the cupola generator A of section 1, so forming generator-gas in said cupola generator, which passes upwardly through the cylinder K above the same, and at the same time any suitable hydrocarbon—such as oil, coal-tar, or asphalt—is fed through the pipe *i* to said cylinder, only a small proportion of hydrocarbon being fed to said cylinder, the amount fed being about one-third of that required in forming the resultant gas, and such small quantity being such as can be easily and quickly broken up within the cylinder, so that all the hydrocarbon so introduced is utilized in gas making, and the quantity fed is not sufficient to have any great effect in cooling down either the gases or the body of carbon or the highly-heated cylinder. The generator-gas and the hydrocarbons introduced into the same then pass upwardly through the pipe *k* and through the valve 1 into the pipe *m*, and thence through the valve 2 into the pipe *l*, and thence into the vertical cylinder L. At the same time steam is introduced into the cupola generator A of section 2, forming hydrogen or carbonic oxide, or "water-gas," as it may be termed, and at the same time superheated steam may be fed through the inlet a^3 of said generator, if desired. As this gas passes up through the cylinder K above the generator like hydrocarbons are sprayed in like small quantities into the gases, and the gases and hydrocarbons pass upwardly through the valve 3 into the pipe *n*, thence through the cross-pipe M into the pipe *m*, and thence through the valve 2, through the pipe *l* into the vertical cylinder L, so commingling with the gases formed in generator A of section 1. As these commingled gases enter the cylinder L a like small quantity of hydrocarbons is sprayed into the upper end of said cylinder, and is broken up by the heat thereof, and the heat of the gases, passing down with said commingled gases into the upper portion of the cupola generator B of section 1, and entering into an atmosphere of hydrogen and carbonic oxide formed within the cupola generator B of section 1 by the passage of steam through the heated carbon therein. It is thus seen that the gases obtained from the hydrocarbons are brought immediately into contact with the nascent hydrogen or the water-gas formed in said cupola generator B in a highly-heated condition and in the proper condition for the union of said hydrogen with the hydrocarbons to form marsh, olefiant gas, and analogous hydrocarbon gases, this union causing the formation of a large volume of such gases. The resultant gas then passes upwardly into the vertical chamber D and through the passage *e'* into the vertical chamber E, and thence through the port *e* into the upper portion of the cupola generator C, where they again enter a like atmosphere of hydrogen and carbonic oxide or water-gas, which is being formed by the passage of steam through the incandescent carbon in said cupola generator, and they pass thence through the pipe *r* into the superheater. In this course the gases are caused to pass through the highly-heated checker work, or like heat-retaining medium in the cylinder chambers D E, and are fixed thereby, and at the same time, as the gases are in a highly-heated state while being so fixed, they act also to maintain the heat around the cylinder K L in said chambers, so that the necessity of reversing the apparatus on account of the cooling of said cylinders, except at long intervals, is overcome.

Particular attention is called to the fact that the oil is injected at different points and in a fine spray with superheated steam, all of it being thus converted into gas without cooling off the fires. This makes the process a continuous one. Bituminous coal is used instead of anthracite or coke, as is used in water gas processes, and when blowing up for a heat coal gas is made instead of the product of combustion being wasted. This is one reason why gas by this process is so inexpensive. By actual tests the company have secured 90 per cent. of the theoretical value of the material used. They have taken out twenty patents on various features of this process.

Heated Air and Steam.

A syndicate has been formed, including manufacturers in Yorkshire and Lancashire, for the development and working the new system of motive power applicable to steam engines, known as the Field M. P. system. It will be remembered that Mr. Edward Field accidentally made the important discovery during some experiments with steam that, if steam and heated air are mixed in certain proportions in place of steam alone, the result is not only that there is nearly 60 per cent. saved in the quantity of water used, but that there is a corresponding saving in fuel. It is stated that the use of heated air with steam in the cylinder of an engine produces far greater results than the use of pure steam alone—in fact, that one volume of steam combined with eight volumes of heated air is capable of producing more power than ten volumes of steam. The correctness of this is said to have been ascertained by numerous trials, an important feature of the discovery being that the heated air can be produced by the waste heat from the furnaces.—[Iron and Coal Trades Review, London.

The Manufacture of Pressed Steel.

It has recently been remarked that only very careful readers of technical literature can realize the advances already made in the manufacture of pressed steel in this country, and the statement is also made, that some of the most complicated forms in this line are now produced here more successfully than in Europe. One of the latest achievements of this character, as noted, is a steel bottle intended for a cream separator—a bottle some nine-sixteenths of an inch thick, uniform thoughout, of eighty pounds weight, and having only one opening, that at the top. It is made from a plain sheet, by several operations, and finally moulded to the desired shape. It is stated that this construction, simple as it is, is a veritable boon to dairymen, as former bottles for this purpose, made of castings of steel and malleable iron, did not possess the requisite degree of safety when revolving at the rate of 7,000 revolutions a minute. Sweden is said to be the only other place where these bottles are manufactured.

Natural Coke.

A seam of natural coke, closely resembling the manufactured article, has recently been discovered in New South Wales at the Bulli Pass coal mines. The coal measure at this point covers an area of about 550 acres and is six feet in thickness. The upper half of this seam is coal of a character differing but little from the ordinary Australian coals, while the lower portion of the measure is a natural coke. The junction of the coal and coke is clearly defined and can be traced all through the workings. This natural coke is slightly heavier than the manufactured article, contains slightly less fixed carbon, but a much smaller quantity of ash and a lower percentage of sulphur. It is stated that it burns without smoke and can be mined for much less than the cost of manufactured coke.—[Coal Trade Journal.

Curious Foundations.

The *Railway Review* tells of a novel method of laying foundations in swampy soil recently employed by an American engineer. The building to be supported was a low wooden one which it was proposed to use for the storage of machinery. Casks were set in holes in the ground along the line of posts and were filled to the depth of about one foot with iron turnings. The posts were placed in the casks, which were then filled with iron turnings compactly rammed in place. A solution of salt and water was slowly poured over the turnings, under the action of which they solidified into a hard mass. The heat of the oxidation of the iron was so great that the posts were charred. This also served to act as a preservative, and to that extent the iron turnings are probably superior to concrete under similar conditions.

The English Iron Market.

S. W. Royse & Co., of Manchester, England, write us as follows, under date of November 28: "Business in pig iron is dull, and prospects by no means cheerful. Prices of Glasgow warrants are a little higher than at the beginning of the month, but transactions have been few and far between. In Middlesbrough iron only a moderate amount of trade has been passing, and prices have declined slowly. Shipments from Middlesbrough are, however, fairly good, being returned at 62,499 tons up to the 23d inst., but there is a slight increase of stock in the public stores. In manufactured iron there is only a very moderate amount of new business passing, but makers are well engaged on old orders."

ONE hundred tons of low carbon steel, the percentage of which runs between 30 and 35 1-100 of one per cent., was made at the Edgar Thomson steel plant, recently. It is the lowest made on record, and was turned out for the Pennsylvania Railroad Co., which will be used for switches and guard rails.—[Pittsburgh Dispatch.

OSCILLATING STEAM ENGINE.

The cuts herewith given represent a new oscillating steam engine patented by Wm. Thomas, of Ovington, Ill., November 10, 1891. The invention relates

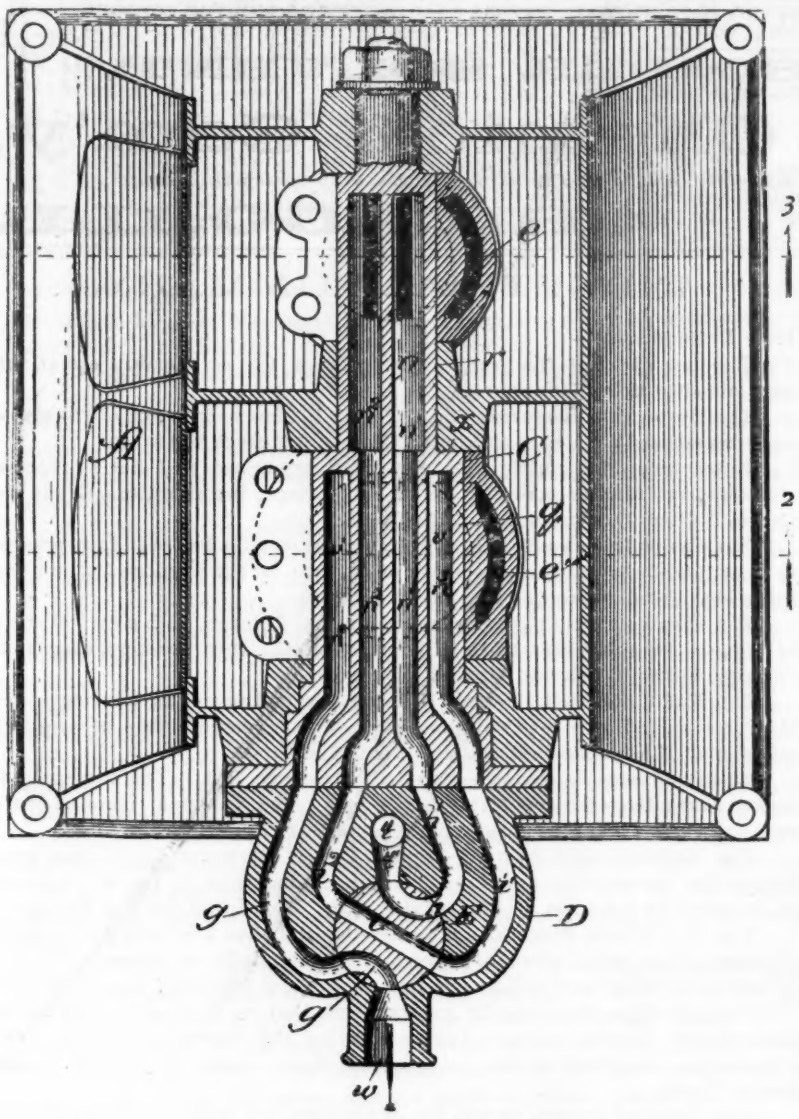


FIG. 1—OSCILLATING STEAM ENGINE.

to an improvement in the class of oscillating steam engines comprising a cylinder supported to oscillate on a pin forming the steam chest and containing ports caused to open by the oscillations of the cylinder into the latter to introduce the steam therein alternately at opposite sides of the piston, the rod of which is connected with the crank-shaft. The object of the invention is to provide with the general construction thus outlined a compound, reversible, valveless, oscillating steam engine, by employing the exhaust steam from one cylinder to actuate the piston in another cylinder or in several other cylinders successively, all the cylinders being supported on the one hollow pin, divided into steam chambers to receive primarily the initial steam supply to and exhaust from the first cylinder and direct the exhaust into the other or others in succession, alternately at opposite sides of the piston of each, having its rod connected with the common crank-shaft or a different crank-shaft.

In the accompanying drawings, Fig. 1 is a sectional plan view of the engine, the section being taken at the lines 1 1 on Figs. 2 and 3 and regarded as indicated by the arrows. Figs. 2 and 3 are vertical sectional views taken, respectively, at the lines 2 and 3 on Fig. 1 and regarded as indicated by the arrows.

Referring to Figs. 1 to 3, inclusive, the operation of the single compound engine is as follows: With the throttle valve E turned to the position represented in Fig. 1, high-pressure steam from the inlet t enters the steam chest chamber n', the duct e then eventually (when the crank with which the piston rod F^2 is connected is moved beyond the center) coinciding with the port p, the ports p' and m being closed by the respective head f and the duct d coinciding with the port m'. Then the steam from the chamber n will enter the cylinder F through the duct e against the under side of the piston therein, driving the shaft H, and the upward stroke of the piston will force any steam previously admitted above it out of the cylinder through the duct d into the exhaust chamber n^2. From the latter the exhaust steam passes through the head passage i^2, valve passage i, and head passage i' into the steam chamber n^3 in the low-pressure section q. There the duct d' will have meantime been brought coincident with the port l' of the chamber n^3, admitting the low-pressure steam therein against the upper side of the piston G′ in the cylinder G, and the duct e', with the port k (the ports l and k' being then closed) allowing the low-pressure steam previously introduced against the lower side of the piston to be forced by its down stroke through the duct e' into the chamber n^4, whence it escapes through the passage g' and the valve passage g to the outlet w. The movements thus described throw the crank-shaft half-way around beyond a dead-center and the completion of its throw oscillates the the cylinders F and G back, bringing the ducts d and d', respectively, to the ports p' and k', leading into the chambers n' and n^4, the ports e and e', respectively, to the ports m and l, the other ports being closed by the heads, whereby steam from the chamber n' enters the cylinder F above its piston to lower it and drive the steam below it through the duct e, port m, chamber n^2, and valve passage i into the chamber n^3, thence into the cylinder G, through the duct e', raising the piston G′ and driving out the spent low-pressure steam previously introduced above it through port k' into the chamber n^4, and thence through the passages g' and g and outlet w. Thus the oscillations of the cylinders F and G continue to rotate the crank-shaft. Obviously to reverse the direction of rotation of the crank-shaft at either end of the stroke of a piston or at any intermediate point between the ends of its stroke, it is only necessary to turn the throttle E to lead the high-pressure steam into the passage i^2 through the valve passage h and produce communication of the passages h' and g' through the valve passage i and of the passage i' through the valve passage g with the exhaust w. The reversal thus produced at any point of the stroke is instantaneous, smooth, and without jarring or injury to

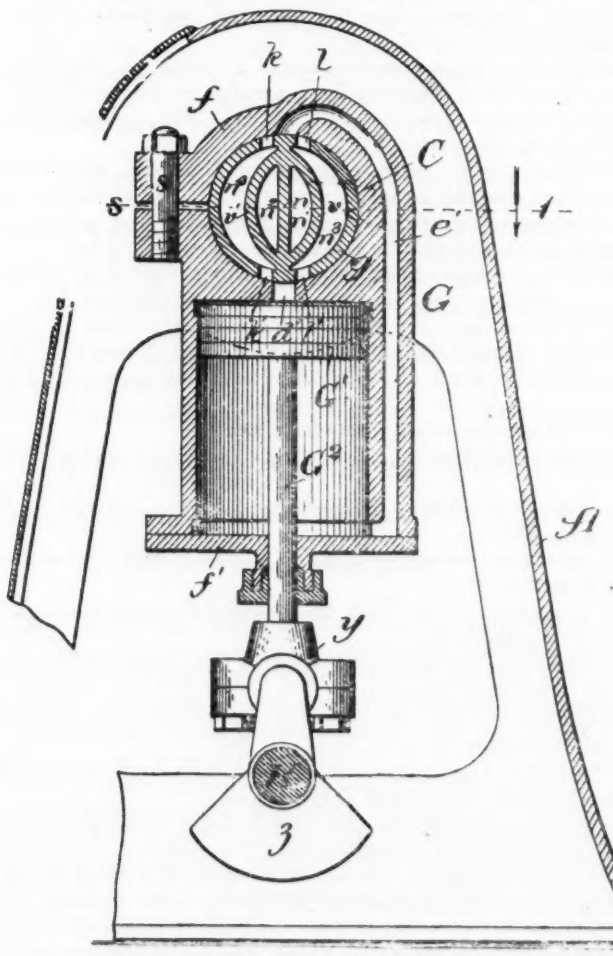


FIG. 2.

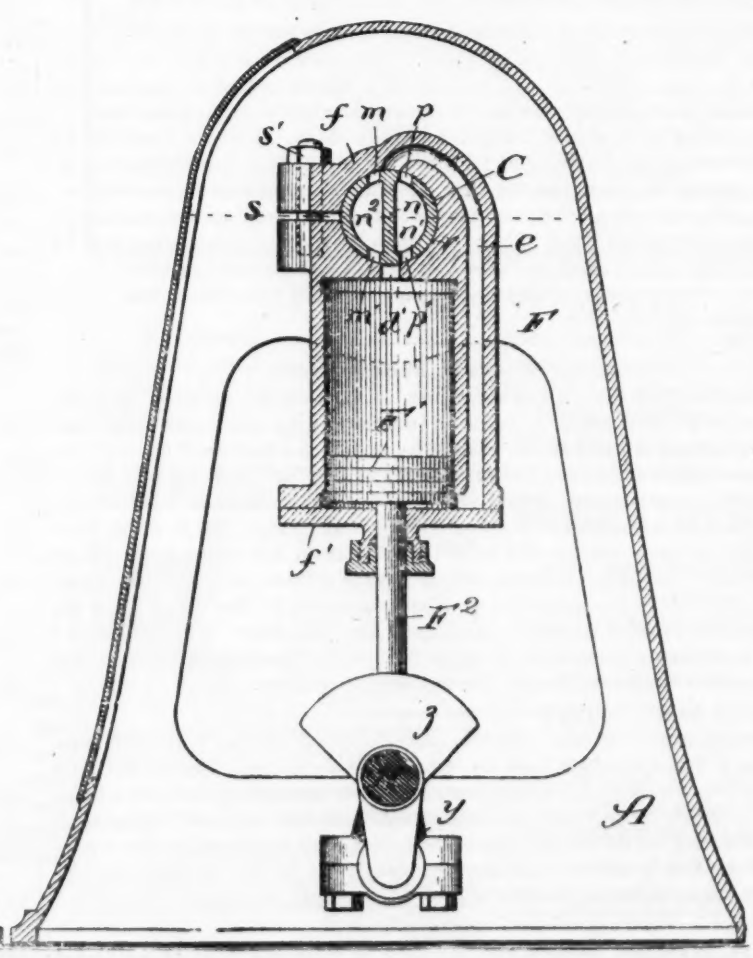


FIG. 3.

OSCILLATING STEAM ENGINE.

STEAM USERS Should Read this.
Increase the Capacity of your Boilers.
Scale is a Non-conductor of Heat.

SAVE YOUR FUEL AND PROTECT YOUR BOILERS FROM SCALE AND GALVANIC ACTION OF WATERS. WATERS ANALYZED **FREE** AND THE COMPOUNDS MADE TO SUIT EACH WATER.

INTERNATIONAL BOILER SOLVENT.
(PURELY VEGETABLE.)

Dearborn Drug & Chemical Com'y,

Manufacturing and Analytical Chemists, W. H. EDGAR, Manager. Office, Room 29, Rialto Building; Works, 4246 Champlain Avenue;
Ohio Office, Canton, O. ROBERT H. CREVOISE Agent. **CHICAGO, ILL.**
WRITE FOR INFORMATION AND PRICES. BEWARE OF INFRINGEMENTS.

the engine, or danger from it. The course of the high-pressure steam is then through the branch i', valve passage h, passage i^2, chamber n^2 into cylinder F'; of the low-pressure steam from chamber n' through valve passage i, passage g', and chamber n^4 into cylinder G, and of the exhausted steam from cylinder G into chamber n^3, and thence through passage i' and valve passage g to the outlet w. In the same manner that the high-pressure cylinder F and low-pressure cylinder G are constructed to compound the pressure of the former into the latter, one or more additional cylinders like the cylinder G, but larger, may be added, all on a common steam chest pin C, thereby to double, triple, quadruple, etc., the compounding or expansion of the initial high pressure steam, the cranks on the shaft or shafts being, of course, set accordingly.

The Workshop Treatment of Steel Castings.

A recent article by M. Louis Campredon contains some interesting remarks on the working of steel castings. When taken from the mold they require fettling and cleaning in the same way as ordinary castings, but the work is harder, especially as regards the removal of the gates, which for steel castings must be very large. Delay is often caused by the difficulty of removing these gates. As regards machining such castings it should be noted that the outer layers are harder than the interior of the casting. This is partly due to the high temperature at which the steel is cast, causing virtification of the walls of the mold, and making grains of the sand to adhere very firmly to the exterior of the casting. At the same time a sort of air tempering seems to occur, which still further increases the hardness of the outer layers. Such castings can be forged without difficulty, and the softer castings can be welded with ease. With harder castings, a satisfactory weld is obtainable, if at all, only by great skill on the part of the workmen. In general, forging improves the quality of the metal, rendering it more ductile as the following results show:

	Breaking Stress. Tons per Square Inch.	Elongation on 4 in. Per cent.
Steel casting unannealed	49.8	5
	51.1	4
Steel casting forged	50.2	8
	50.9	9
Steel casting forged and annealed	50.6	13
	51.6	13 3

In forging ordinary steel castings having a strength of 28 to 30 tons per square inch, bad results are often obtained. These are usually due to working the steel at too high a temperature, viz, above a cherry red, or to the fact that only portions of the casting have been hammered, without subsequent annealing of the casting as a whole. When carefully done, however, there is no doubt that forging, particularly if followed by annealing, considerably improves the material. The temperature at which annealing is carried out should be proportioned to the hardness of the metal, and to the amount of forging it has undergone. For hard steels the temperature of annealing may be above cherry red, whilst with soft steel it should not exceed a yellow heat. For steels of intermediate hardness, temperatures between these two limits may be adopted.—[Engineer.

Old Iron Works in Massachusetts.

The discovery of conclusive evidences of an iron-works plant and the existence of iron ore at North Beverly, in this State, give rise to the belief that the industry was once carried on at this point. It is a matter of history that such a plant existed at or near Saugus as early as 1643, and iron ore was mined there, but this new discovery would indicate earlier operations. It is stated that there were settlements in this locality previous to 1640, and it must have been that the industry was carried on before that time, but when or by whom is the question. The question that is now puzzling those interested is, when were the iron works in operation at North Beverley? Was it prior to the establishment of those at Saugus? And how can the dates be established? These are interesting questions in connection with the early history of the industry in this country.—[Boston Manufacturers' Gazette.

A CORRESPONDENT of the *Manufacturers' Record*, writing from Jefferson, Texas, says: "The Lone Star Iron Co., which has a charcoal furnace in blast making pig iron equal to the finest Scotch iron, is preparing to build a large cotton tie mill to supply Texas, Louisiana and Southern Arkansas. This company is also going to make merchant steel, bar and flat iron, in fact it proposes within a few years to manufacture nearly all of its pig iron into the finished product. Another furnace will be built within 18 months."

HOLIDAY excursion tickets will be sold at reduced rates at all ticket stations of the Pennsylvania Lines on December 24th, 25th and 31st, 1891, and on January 1st, 1892, good returning until January 4th, 1892.

TRAVEL on the Nickel Plate and receive the benefits of Holiday rates, December 23d to January 5th, 1892.

INDUSTRIAL SUMMARY.

New Enterprises:—

The new works of the Frankie Steel Range Co., on Harvard street, this city, will start up by January 1st.

The Harper Manufacturing Co., of Peoria, Ill., has been organized to manufacture patented articles of all kinds. The capital stock is $200,000

Pennsylvania Lubricating Co. has been organized at Joliet, Ill.; capital stock, $25,000; for the manufacture of lubricators; incorporators, Grant McCargo, William Gardner and F. C. Caldwell.

The Taylor Decarbonized Iron & Manufacturing Co. has been incorporated in Montreal, Can., with a capital stock of $150,000, for the purpose of manufacturing decarbonized iron by the Taylor process.

The Corning Steel Co. has been organized at Chicago, with a capital stock of $250,000, for the manufacture of iron and steel. Incorporators, Charles S. Corning, Frank B. Felt and William O. Johnson.

P. J. Kuhbacker, L. L. Everett, H. D. Halbert and others have incorporated the Electric Scales Co., of Covington, Ky., for the manufacture of weighing scales, etc. The authorized capital stock is $1,000,000.

A new industry is springing up in Providence, R. I. The enterprise is known as the United States Metal Bending Co. The principal class of work now being done is the making of pipe hangers or clips.

The Andrews Anti Friction Journal Co., of Syracuse, N. Y., has been formed, for the manufacture and sale of journal bearings, by Jas. M. Andrews, M. A. Andrews and Chas. E. Fish, of that city. The capital stock is $10,000.

The Hall-Kirsch Steel Co., of Anderson, Ind., has filed articles of incorporation with a capital stock of $65,000. It is intended to establish a plant for the manufacture of steel billets and steel castings, at Irondale, near Anderson.

The Ashe Manufacturing Co., capital stock $500,000, has been organized at Portland, Me., for the purpose of manufacturing and leasing machinery. The officers are: President, Robert Ashe, Boston, Mass.; Treasurer, James F. Chase, Boston, Mass.

The Robinson Siphon Burner Co, of Chicago, has been incorporated. The company intends to manufacture smoke-preventing and fuel-saving devices; capital stock, $250,000. The incorporators are Frank T. Robinson, A. L. Dickinson and I. E. Adams.

The McKenzie Economic Smokeless Furnace Co. has been organized at Chicago, Ill., and will manufacture apparatus for the saving of fuel and the suppression of smoke; capital stock, $50,000. The incorporators are Dugal McKenzie, G. W. Haggett and J. D. Lansing.

The Harris Car Co., with a capital of $1,000,000, will probably locate at Putnam, Conn., providing the citizens of that place will submit to the terms proposed, which will give the company 50 acres of land, subscriptions to $50,000 of stock and exemption from taxes for a term of years.

The Mekarski American Compressed Air Motor Co., of North Tarrytown, N. Y., have been incorporated. The company will manufacture and sell compressed air motors, etc., and the capital stock is $1,000,000. The following are the directors: Edward Nichols, Addison C. Rand, James F. Lewis, Charles B. Johnson, Edwin F. Abell, C. Philip Laurenson and George E. Whipple.

Additions, Enlargements, Removals, Etc.:—

The Haugh-Ketcham Co. is building a new $8,000 foundry at Indianapolis, Ind.

A new foundry building, 300x100 feet is being erected by the Dunkirk, (N. Y) Locomotive Co.

It is announced that the Buffalo Cast Iron Pipe Co. will erect a large foundry at Buffalo, N. Y.

The Harriman (Tenn.) Tack Co. has made arrangements to increase the capacity of its tack factory

The Milwaukee Car Wheel & Foundry Co., of Milwaukee, Wis., has decided to remove to St. Paul, Minn.

The Presque Isle (Me) Electric Light Co.'s plant is to be greatly improved, to meet an increasing demand.

An increase of $100,000 is understood to have been made in the capital of the Troy Malleable Iron Co., of Troy, N. Y.

The Lincoln Iron Works, Rutland, Vt., are making additions to their property, preparatory to increasing their business.

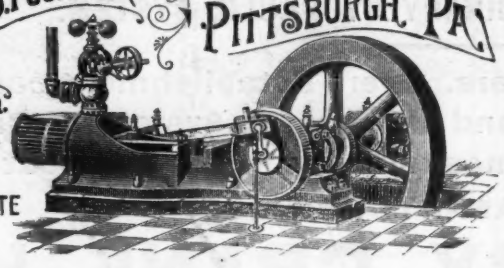
The Trenton Malleable Iron Co., of Trenton, N. J., have found it necessary to erect additional buildings, which will double their capacity.

The Belden Machine Co., of New Haven, Conn., will build an addition to their works, the dimensions of which will be 250x75 feet and two stories high.

The Steel Barbed Fence Ribbon Co. will erect a building, 100x30 feet, at Denver, Col. The company were recently organized with a capital stock of $250,000.

The Damon Safe & Iron Co., of Boston, Mass., are announced as having

THE AETNA MEDIUM & HIGH SPEED ENGINE
Manufactured by THE TOTTEN & HOGG I. & S. FOUNDRY Co. PITTSBURGH, PA.
150 to 2000 H.P. Latest Design.
FOR ROLLING MILLS AND ALL OTHER WORKS WHERE LARGE POWER AND CLOSE REGULATION IS REQUIRED
CONTRACTS MADE FOR COMPLETE STEAM PLANTS.
ENGINES ALWAYS IN STOCK.



The Hackney Power Hammer

The Measure of Excellence and Profit.

The durability of the machine and the quantity—with quality—of work produced, is nowadays the measure of excellence and profit, and in this respect the "Hackney" is far in the lead.

It surpasses other power hammers in durability, speed and quality of work.

Write for catalogue and prices.
THE HACKNEY HAMMER CO.
Cleveland, O.

decided to locate at Waukegan, Ill., where they will complete and occupy the plant started by the late Chicago Safe & Lock Co.

Owing to an increase of business and a lack of room, W. J. Burton & Co., of Detroit, Mich., have been obliged to move to larger quarters and their present location is 164 Larned street west and the back of 165, where they will continue the manufacture of their Eastlake shingles, galvanized iron and copper cornice, window caps, skylights and a general roofing business the same as formerly.

Articles of incorporation of the Graves Elevator Co., of Rochester, N. Y., have been filed: The capital stock of the incorporated concern is $400,000 and the incorporators are L. S. Graves, Fred B. Graves, Charles V. Grohs, R. A. Heimburger, and William S Denny. All of the members of the new concern have been for many years connected with the firm of L. S. Graves & Son who have hitherto conducted the business to be carried on by the corporation after January 1st. As was mentioned last week, the new company will enlarge the plant. The present building will be carried up six stories, and new wood-working and boiler shops will be constructed. Mr. L. S. Graves, the founder of the new concern, began by manufacturing elevators for shoe factories, in connection with other machinery, but the demand for his elevators soon compelled him to turn his whole energies in the one direction of making elevators. The demand steadily increased, and the factory has been enlarged fifteen different times, until the present output is one elevator per day. Now, however, the business has outgrown its present capacity, and the contemplated enlargement will place the establishment in the front ranks of elevator manufacturers.

The Webster, Camp & Lane Machine Co., of Akron, O., we are authoritatively informed, manufacturers of mining machinery and Corliss engines, have completed arrangements by which a part of their business will be removed to Kent, O., ten miles east of Akron, where buildings will be erected for the manufacture of their heavy machinery. While the company will continue their offices in Akron, and use of their present shops for their local work, they will erect at Kent complete shops, consisting of machine shops and main erecting shop 100 feet wide by 400 feet long, built with 25 feet galleries on either side of a 50 feet crane span; foundry building 100 feet wide by 300 feet long, with 75 feet by 100 feet; smith shop 60 feet by 80 feet, besides pattern shop and pattern storage building. Both machine shop and foundry will be equipped with thirty-ton electric cranes of most approved pattern. All buildings are to be of brick, and erected on a 12-acre tract of land situated between the N. Y., P. & O. Division of the Erie Railway, and the Pittsburgh & Western Division of B. & O. The Cleveland, Canton & Southern Railway runs across the south end of the property, so that the company will have unsurpassed shipping facilities. The company have been very much cramped for room in their old works, and so hemmed in on all sides that additions there were out of the question. They expect to start the new works with 300 men in addition to force employed in Akron, and this number will be increased as fast as required.

Fires and Accidents:—

Lock & Lincoln's machine shops, at Marion, Va., have been burned, at a loss of $10,000.

The Arc Light & Power Co., Chicago, Ill., was destroyed by fire, with many dynamos; loss $300,000.

The Wentworth Spring & Axle Works, at Gardiner, Me., have been damaged by fire to the extent of $17,000; insured.

A Cylindrical Steel Car.

A cylindrical steel car owned by B. A. Atkinson & Co. is being exhibited in Boston. The body of the car is a cylinder formed of steel plates riveted on 12 ribs of quarter iron, set 4 feet 9½ inches apart, and bent to conform to the shape of the car. The sides are almost entirely occupied by a dozen very wide windows, which, being perpendicular, stand out from the curving sides of the car several inches at the top of the window. These and the monitor roof, which is separate from the body of the car, somewhat relieve its cylindrical appearance on the exterior. The trucks are Jewett four-wheelers, and two heating boxes are hung under the car. The platforms are double, with heavy springs to take up the force of any collision.—[National Car Locomotive Builder.

Holiday Excursion via Pennsylvania Lines.

Excursion tickets will be sold at reduced rates at all ticket stations of the Pennsylvania Lines west of Pittsburgh, on December 24th, 25th and 31st, 1891, and on January 1st, 1892; good returning until January 4th, 1892, inclusive.

THE Nickel Plate makes one fare for the round trip, December 23d to January 1st, inclusive, account Holidays. Returning limit to January 5th, 1892.

THE STIRLING COMPANY
MANUFACTURE
The Safest, Most Economical, Compact and Durable High Pressure
WATER TUBE BOILERS
All Wrought Steel. Large Mud Drum. Perfect Circulation.
By removing four manhole covers access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed.
GENERAL OFFICE: Pullman Bl'g., Chicago. PITTSBURGH OFFICE:- Lewis Block. NEW YORK OFFICE 74 Cortlandt St.
Works: BARBERTON, SUMMIT COUNTY, OHIO.

BLANK BOOKS
Ruled to any pattern.
Best material and workmanship.
CLEVELAND P'T'G & PUB. CO.,
Cleveland, Ohio.
☞PLEASE SEND FOR ESTIMATES.

EXHAUST STEAM HEATING
BY THE WILLIAMES VACUUM SYSTEM, WITHOUT BACK PRESSURE UPON THE ENGINE GUARANTEED.
Patent No. 256,089, dated April 4th, 1882, sustained in two suits in the United States Circuit Court.
The system has been adopted by over 300 of the largest buildings including mills, churches, office buildings, theatres, schools, asylums, hotels and electric light companies in this country.
ADVANTAGES GUARANTEED.
Removal of all back pressure, thereby increasing power of engine and saving of over 25 per cent. in fuel, compared with the back pressure system of forcing the steam through the heating pipes. The prominent feature consists in a given quantity of exhaust steam being circulated and uniformally distributed through double the amount of heating that could be accomplished by the same quantity of exhaust steam when forced into the heating system by pressure.
Send for descriptive catalogue with convincing proofs and references.
WARREN WEBSTER & CO., (Main Office and Works, 491 N. 3rd St.) Philadelphia.
Patentees, Owners and Manufacturers of the "Webster" Vacuum Exhaust Steam Economizer Feed Water Purifier. (Send for illustrated catalogue).

POSITION WANTED.
A founder, who has had 29 years' experience, wants position where he can have charge of one furnace, or two if close together. Understands the business thoroughly and can give the best of references. Address Founder,
Care of "IRON TRADE REVIEW," Cleveland, O.

SHEPARD'S NEW $60 SCREW CUTTING Foot Lathe
Cap Lathes, $1.25

Foot & Power Lathes, Drill Presses, Scroll Saw Attachments, Mandrels, Chucks, Twist Drills, Dogs, Calipers, etc. Lathes on trial. Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address H. L. SHEPARD, Agt., 124 East Second St., Cincinnati, O.

SPICER MANUFACTURING CO.,
New Philadelphia, O.
General Foundry and Machine Work,
Heavy and Light Castings.
Privilege to make estimates solicited.

Plate Iron Washers
A SPECIALTY!
Even in Gauge, smooth and well finished.
Cut from new plate, rolled expressly for the purpose. ☞Write for prices. Address,
MILTON MFG. CO., Milton, Pa.

Wheeling & Lake Erie Railway.
THE NEW THROUGH LINE
BETWEEN
TOLEDO
—AND—
Steubenville, Pittsburgh, Marietta.
THROUGH COACHES
BETWEEN
Toledo & Marietta.
Through Sleepers Between
PITTSBURGH AND CHICAGO
AND DAY COACHES BETWEEN
Toledo and Pittsburgh, Via Akron, Cuyahoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.
The Only Line running through
"BEAUTIFUL ZOAR."
A. G. BLAIR, Traffic Manager. IAS. M. HALL, Gen'l Pass. Agent.

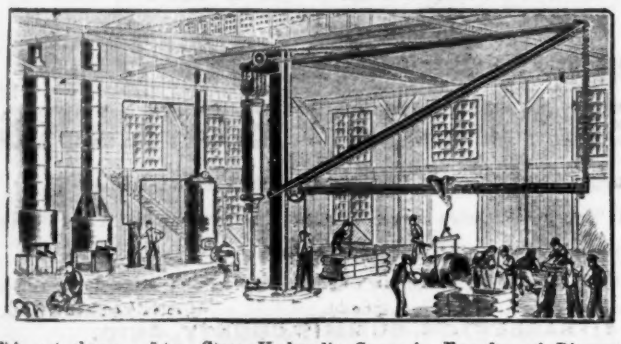
THE RIDGWAY STEAM-HYDRAULIC SYSTEM OF BALANCED CRANES.

FAR SUPERIOR TO THE ORDINARY HYDRAULIC SYSTEM.

No Pumps. No Accumulator. No Shocks or Jars. Every Establishment can save Thousands of Dollars by adopting this Cheap and Unequaled System of Cranes for handling goods. Don't Buy Cranes until you learn all about the

RIDGWAY STEAM-HYDRAULIC.

THE BEST FOUNDRY CRANE KNOWN.



This cut shows a 5-ton Steam-Hydraulic Crane in Foundry of Diamond State Iron Co., Wilmington, Del.

At the present moment we are making these cranes for

Benwood Iron Works, - - - **Wheeling, W. Va.**
The largest nail works in West Virginia.

Old Dominion Iron and Nail Works Co., - **Richmond, Va.**
The largest iron and steel works in Virginia.

National Tube Works Co., - - - **McKeesport, Pa.**
The largest pipe works in the world.

Pennsylvania Steel Co., - - - **Steelton, Pa.**
The largest steel works in the U. S.

Reading Iron Co., - - - - **Reading, Pa.**
The largest iron works east of the Alleghenies.

THIS TELLS THE WHOLE STORY!

SEND FOR CIRCULARS GIVING FULL PARTICULARS.

CRAIG, RIDGWAY & SON, - Coatesville, Pa.

LARGE CONCERNS WHO HAVE RIDGWAY STEAM-HYDRAULIC CRANES IN USE.

National Tube Works Co., McKeesport, Pa.
Henry Disston & Sons Co., Tacony, Philadelphia, Pa.
Phœnix Iron Co., Phœnixville, Pa.
A. & P. Roberts & Co., Pencoyd, Philadelphia, Pa.
Passaic Rolling Mill Co., Paterson, N. J.
Catasauqua Manufacturing Co., Catasauqua, Pa.
Mahoning Rolling Mill Co., Danville, Pa.
Harrisburg Rolling Mill Co., Harrisburg, Pa.
Harrisburg Car Co., Harrisburg, Pa.
Wm. Neal & Sons, Bloomsburg, Pa.
Atlantic Refining Co., Point Breeze, Philadelphia, Pa.
E. & G. Brooke Iron Co., Birdsboro, Pa.
Wm. L. Bailey & Co., Thorndale, Pa.
Glasgow Iron Co., Pottstown, Pa.
W. W. Kurtz & Sons, Coatesville, Pa.
Kilmer Manufacturing Co., Newburgh, N. Y.
Port Henry Furnace Co., Port Henry, N. Y.
Akron Iron Co., Akron, Ohio.
Crane & Breed Manufacturing Co., Cincinnati, Ohio.
Diamond State Iron Co., Wilmington, Del.
J. W. Friend & Co., Wheatland, Pa.
National Pipe & Foundry Co., Scottdale, Pa.
West Superior Iron Co., West Superior, Wis.
Hartman Manufacturing Co., Beaver Falls, Pa.
Shoenberger & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburgh, Pa.
Oliver Bros. & Phillips, Pittsburg, Pa.
Moorhead, McCleane & Co., Pittsburg, Pa.
Jones & Laughlins, Pittsburg, Pa.
Spang Steel & Iron Co., Sharpsburg, Pa.
Apollo Iron & Steel Co., Apollo, Pa.
Pittsburg Steel Casting Co., Pittsburg, Pa.
Johnson Co., Johnstown, Pa.
Cambria Iron Co., Johnstown, Pa.
Standard Iron Co., Bridgeport, Ohio.
Chester Rolling Mill, Thurlow, Pa.
Valk & Murdock, Charleston, S. C.
B. Atha & Illingworth Co., Newark, N. J.
Canda Mfg. Co., New York City.
Norristown Steel Co., Norristown, Pa.
Hughes & Paterson, Philadelphia, Pa.
Sherman & Co., Antwerp, Belgium.

The Best Republican Newspaper.

The Tribune for '92

Roswell G. Horr on the Tariff.

The Republican party, triumphant in 1891, wherever national issues were at stake, renews, aggressively and bravely, the fight for 1892. THE NEW YORK TRIBUNE, the ablest, most reliable, and best of Republican papers, leads the way.

During 1892, Roswell G. Horr, of Michigan, the witty orator, will continue in THE TRIBUNE, his remarkable articles on the Tariff, Reciprocity, Coinage and the Currency. These topics are all understandable; the Republican policy with regard to all of them is right, patriotic and impregnable; but dust has been thrown in the people's eyes, and the air has been filled with fog, by lying and tricky Tariff-Reformers. THE TRIBUNE prints from one to five exceedingly entertaining articles every week explaining these questions.

Mr. Horr begins at the beginning of every subject, and makes it so clear that everyone can understand, and no one can answer him. Ask any neighbor what he thinks of Mr. Horr's writings. He will tell you that they are genial, clear, entertaining and perfectly unswerable. A specialty is made of answering all questions, asked in good faith, on the Tariff, Reciprocity, Coinage, the Currency and the projects of the Farmers' Alliance. THE TRIBUNE is the best national Republican paper to supplement your local paper during 1892.

How To Succeed In Life.

THE TRIBUNE will also continue the series of articles to Young Men and Women, penned by men who, beginning life themselves with few advantages, have nevertheless succeeded honorably and brilliantly. It will also reply to questions as to what young men and women should do to succeed in life, under the particular circumstances in which their lot in life is cast. The replies will be written under the direction of Roswell G. Horr, whose familiarity with American life and opportunities and whose deep and cordial sympathy with all who are struggling under adverse circumstances, promise to make the replies practical and satisfactory.

Vital Topics of the Day.

Many special contributions will be printed from men and women of distinguished reputation. Among the topics are: "Silver Coinage, the latest views;" "Proper Function of the Minority in Legislation," to include one paper each from a Democrat and a Republican, prominent in public life; "Harmful Tendencies of Trusts;" "Arid Lands of the United States;" "Millionaires of the United States;" "Free Postal Delivery in Rural Communities;" "Better Pay for Fourth Class Postmasters;" "Importance of the Nicaragua Canal;" "Village Improvement;" "Our German Fellow Citizen in America," and many others."

Agriculture.

In addition to the regular two pages a week of how to run a farm and make it pay, there will be, during 1892, special papers on "Hot House Lambs," "Model Farms," "Tobacco Raising," "Sugar Beets," "Fancy High Priced Butter Making," "Care of Bees," "Market Gardening," "Live Stock," and a variety of other equally important branches of American farming.

For Old Soldiers.

For veterans of the war there will be a page a week of war stories, answers to questions, news and gossip. Mrs. Annie Wittenmyer will supply an interesting column of news of the W. R. C. THE TRIBUNE'S War Stories of the past year have never been surpassed for thrilling interest.

For Families.

Families will value the pages devoted to "Questions and Answers," "Household Decoration," "Home Interests," "Cooking," "Knitting and Crochet," "Young Folks," and the Fashions.

A great editorial page will be printed, and fiction, foreign letters, book reviews, travels, checkers and chess and fun abundantly supplied.

Premiums.

Descriptive circular will be sent free.

Over $2,000 in Cash Prizes.

Send for terms to agents and raise a club for THE TRIBUNE.

Subscriptions.

WEEKLY, $1. SEMI-WEEKLY, $2. Free for the rest of 1891, to those subscribing now for 1892.

THE TRIBUNE, - - New York.

ECLIPSE ELECTROTYPE ENGRAVING CO.
AUST & CLARK PROPRIETORS
LITHOGRAPH BUILDING CLEVELAND, O.

MUNN & CO
SCIENTIFIC AMERICAN AGENCY for
PATENTS
A pamphlet of information and abstract of the laws, showing How to Obtain Patents, Caveats, Trade Marks, Copyrights, *sent free.*
Address MUNN & CO.
361 Broadway,
New York.

MICHIGAN

EMERY WHEEL CO.

194 Catherine St., Detroit, Mich.

Solid Emery & Corundum Wheels, to Run Wet or Dry, Special Shapes.

Perfection Saw Gummers.

SEND FOR PRICE LIST.

To Advertisers

If you wish to advertise

and need instruction, send one dollar for our "Book for Advertisers." A little study of that book will enable you to decide what you ought to do, and give an idea of the probable cost.

If you instruct us

to place a certain amount of advertising for you in the way we think will do you the most good, you should send an explicit statement of what you wish to accomplish, and make suitable arrangements for payment. Your order will then receive all the attention that it requires.

If you wish an advertisement

prepared and a plan of advertising marked out; to be told what papers you should use, and what the cost will be, we will furnish the advertisement and the plan—either or both, and submit them for your consideration, together with our bill for the service.

For preparing advertisements,

electrotypes and estimates the advertiser pays us. For the expense of placing advertisements and watching the fulfillment of contracts we are paid by a commission allowed by the publisher of the paper in which the advertisement appears.

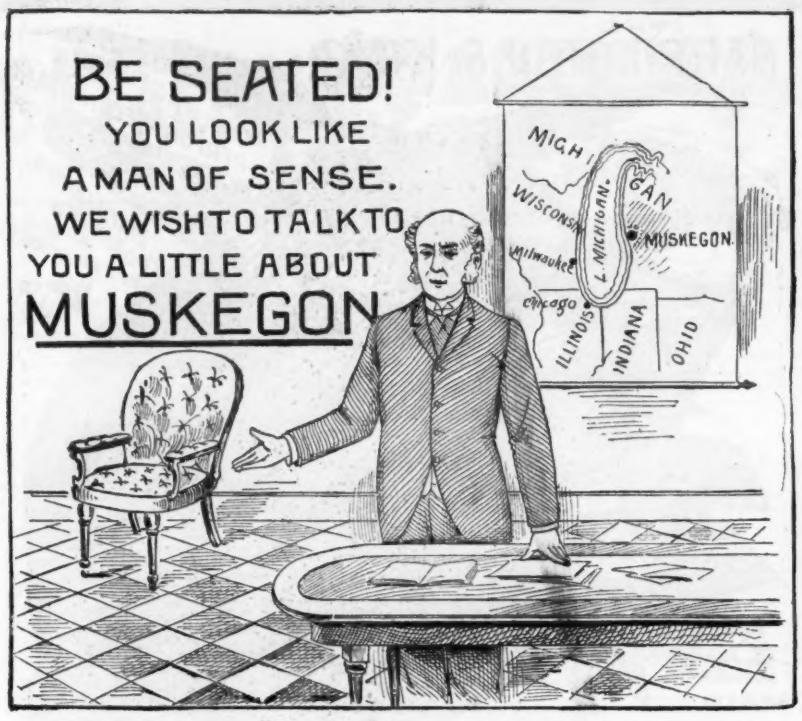
If you want to learn

all the ins and outs of advertising without any cost or trouble, read PRINTERS' INK regularly, carefully, studiously; issued weekly, $2 a year.

If you wish a complete catalogue of all newspapers, send $5 for the American Newspaper Directory.

For any further information address

GEO. P. ROWELL & CO.,
Newspaper Advertising Bureau,
10 SPRUCE ST., NEW YORK.



I wish to say to you that for the Manufacturer or Investor

THE CITY OF MUSKEGON, MICH.,

offers greater opportunities, has more real merit than ANY young City of the United States.

I AM aware that this is a BOLD STATEMENT, but I am prepared to give **Facts and Figures that will astonish you.** Notice this map on the wall, the Lake Michigan District, four States, having a common center (Lake Michigan). These four States, bordering on the **only** great body of water lying **wholly** within the United States, have an average age as States—61 years—and no district of the world ever made such a **record.** These four States: Illinois, Indiana, Michigan and Wisconsin, had, by the census of 1890, 9,781,255 population, or nearly **one-sixth** of the entire population of the Union; they have over **one-fifth** of the railway mileage of the United States, and over **one-tenth** of the railway mileage of the **world**; and talk about rapid growth—**Look at this table:**

NAME OF STATE.	GAIN LAST 30 YEARS.	PRESENT POPULATION—1890.
ILLINOIS	2,106,585	3,818,536
INDIANA	1,514,117	2,189,030
MICHIGAN	1,340,679	2,089,792
WISCONSIN	907,016	1,683 897
TOTAL	5,868,397	9,781,255

This 30 years gain—5,868,397—is MORE than the present ENTIRE POPULATION of the following FIFTEEN STATES, viz:

NOTE:—

MICHIGAN, which is twenty years younger than Illinois or Indiana, made nearly

23 PER CENT.

of the entire gain of this four-state district for the last thirty years.

THE FOUR-STATE GAIN WAS 5,868,397.

The present population of this four-state district is 9,781,255 or MORE than the 22 opposite: ☞

See U. S. Census 1890.

1	California	1,204,002
2	Colorado	410,975
3	Connecticut	745,861
4	Maine	660,251
5	Vermont	332,205
6	New Hampshire	375,227
7	Rhode Island	345,343
8	Delaware	167,861
9	Montana	131,769
10	Nevada	44,327
11	Washington	349,516
12	Utah	206,498
13	Oregon	312,490
14	North Dakota	182,425
15	South Dakota	327,848
	Total	5,796,598
16	West Virginia	760,448
17	Maryland	1,040,431
18	Florida	390,435
19	Idaho	84,229
20	New Jersey	1,441,017
21	Wyoming	60,589
22	New Mexico	144,862
	Total	9,718,609

NOTE.—Michigan gained more population in the last **30** years—see table above—than the present entire population of Connecticut, Vermont and Delaware combined, or within 5,000 as much population as Oregon, Washington, Colorado, Montana and Nevada have combined.

NOTE.—Michigan gained more population in the last **10** years than **Virginia and Georgia** together gained, or than **Kentucky and Tennessee,** or **Alabama and Mississippi** combined gained.

YOU ARE SURPRISED AT THIS.

It was your impression that all the growth and wealth of this district was at the south end of Lake Michigan, but let me tell you right here that the great intrinsic wealth is farther north, in the Iron, Copper, Salt and Timber district. The hardwood forests have scarcely been touched. Michigan puts out yearly over half the Iron Ore mined in the United States; more than all the Southern States combined. Nearly every pound of Steel made in Pennsylvania and Ohio is made from Ore coming from this district, (96.3 per cent of the Steel output of the United States for 1890 is accredited to six States lying along the **Great Lakes**) and this output was 100,000 tons more than that of Great Britain for 1889—**MICHIGAN FURNISHED THE ORE.**

When You Have Absorbed

THE

FOREGOING FACTS AND FIGURES

You are beginning to reach a point where you will appreciate the location of the City of

MUSKEGON.

Notice on this Map on the wall, and in the Cut below,

MUSKEGON'S CENTRAL LOCATION

IN THIS GREAT

TEN MILLION POPULATION DISTRICT.

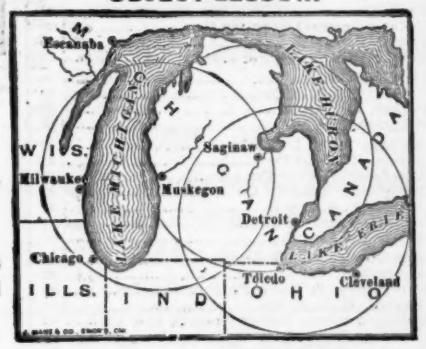
IT HAS THE BEST LOCATION IN MICHIGAN.

LOOK AT THIS!

3 MICHIGAN CIRCLES.
3 NAVIGATION CITIES.

Radius of Each Circle, 125 Miles.

OBJECT LESSON.



POPULATION:—Each Circle has in round numbers in United States population as follows:

SAGINAW CIRCLE,	**1,725,000**
DETROIT CIRCLE,	**2,600,000**
MUSKEGON CIRCLE,	**2,725,000**

NOTE.—See Cram's Atlas, Census 1890, by Counties.

The great business centers of this Lake Michigan District are the Coast Cities. Muskegon is third in size on this great body of water and has the finest natural inside Harbor on Lake Michigan, sixteen miles of water front, all available, deep water—114 miles from Chicago and 85 miles from Milwaukee, with which two cities **navigation is open the year round.** Only 175 miles by navigation from the greatest **Bessemer Ore** shipping docks in the **world.** Rare combination—**Raw Materials, Best Shipping Facilities and Best Markets** in the United States.

IT IS AN ACTUAL FACT that cargoes of heavy merchandise can be carried from **Muskegon** to the business center of **Chicago quicker** and for **less money** than the same quantity can be brought in **by rail** from points 10 to 15 miles outside the limits of Chicago. No experiment. Doing it now.

These great advantages are beginning to be appreciated. Twenty-one factories hav been located in the last eighteen months. Among the factories secured are: **The Alaska Refrigerator Co., Large Rolling Mill, New Steel Works, Chase Bros. Piano Co., Sargeant's Invalid Chair Co., Nelson Piano Co., Mich. Washing Mach. Co., Malleable Iron Works, Machine and Foundry Co., Electric Alarm Co., Shaw Electric Crane Co., Houck Furniture Co., Electrical Power Co., Muskegon Cracker Co., Standard Oil Co. Barreling Works, Morton Key Seating Co., Kelly Bros. Mfg. Co., Heaps Earth Closet Co., Gray Bros. Mfg. Co., Hartshorn Shade Roller Co., New Flouring Mill**—All just completed or now building.

Why do you "CHASE RAINBOWS" on the outskirts of the Country, and invest at high prices, when you can get property near the great business center of the "Central West" for half the money, and having double the intrinsic worth?

A GOLDEN OPPORTUNITY IS BEFORE YOU.

THE MUSKEGON IMPROVEMENT CO., composed of leading citizens, have just commenced their **2nd Great Lot Sale. 2,000 Lots** at the uniform price of **$165 each,** location to be determined by allotment as soon as 50 per. cent. is paid in. **Terms of Subscription:** $15 down, balance $10 each month. $165 secures you a good lot, 50x125 feet, with alley in rear, in the phenomenal addition **"MUSKEGON HEIGHTS,"** which addition is pronounced by Real Estate Experts to be as fine an addition as any city in this country can show. It is less than one and one-half miles from the business center of the City of Muskegon, with which it is connected by handsome, paved streets and an Electric Street Railway. This addition has twelve **large** factories located upon it **now**; has good Hotel, Brick Blocks and Stores, Depot, three paved streets, a large number of good residences. Every lot is level and desirable. **There is not a lot on the addition worth less than the price asked.** The net avails of this sale to be used to locate ten more factories. All the factories on Muskegon Heights are solid, substantial brick structures, the smallest is 50x150 feet, 2 stories; the largest plant is two buildings, each 60x400, one 2 stories, the other 3 stories high; the latter plant is owned by four Bank Presidents and is the largest factory of its kind in the world. **DON'T MISS THIS OPPORTUNITY. Such chances for sure paying investment are rare.**

If you wish to subscribe, remit by Money Order, P. O. or Express, or Bank Draft, to

F. H. HOLBROOK, Sec'y Board of Trade, or

HOLBROOK & McDONALD, SALES AGTS.,

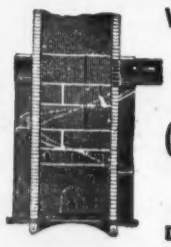
MUSKEGON IMPROVEMENT CO.

REFERENCES: Any Bank in the City of Muskegon. Send for Maps, Plats and Information.

Alphabetical List of Advertisers

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month the double dagger (‡) once in three weeks.

	PAGE
Aitchison, Rob't Perforated Metal Co	21
Adt, John & Son	18
*Arey, Clarence O.	—
†Armstrong Bros.	—
American Bridge & Iron Co.	20
Buckeye Engine Co	26
Burton, W. J. & Co.	20
Bischoff, F. F. & Co	22
*Berger Mfg. Co	25
Babcock & Wilcox Co.	26
Buffalo Specialty Mfg. Co.	24
Bostwick Steel Lath Co	19
†Butman Furnace Co.	—
Brown, W. W.	21
Barr Electric Mfg. Co.	23
Cleveland City Forge & Iron Co	26
Cleveland Twist Drill Co.	26
Cleveland Iron Mining Co.	19
Cleveland Rolling Mill Co	19–22
Cleveland Desk Co	19
Condit Fuller Co.	19
*Copeland & Bacon	18
Colliau, Victor	18
Canton Iron Foundry Co.	—
Cambridge Roofing Co.	25
Cole, J. Wendell	26
Chester Steel Casting Co.	21
*Cincinnati Corrugating Co.	21
*Chandler & Taylor Co	—
Corrigan, Ives & Co.	19
Craig, Ridgway & Son	16
Deming Co	24
Dearborn Drug & Chemical Co.	14
Dixon, Jos., Crucible Co.	21
Egan Co.	21
Edison General Electric Co.	21
Eberts Bros.	26
Eclipse Electrotype & Engraving Co.	16
Frank & Co.	24
Fleharty, J. H & Co	22
Felkel, F.	22
Fitzgerald, W. T	20
Graham Twist Drill Co	26
Garvin Machine Co	21
*Garfield Injector Co.	19
Garry Iron Roofing Co.	25
Graves, L. S. & Son	21
Gerlach, Peter & Co.	19
*Gillette & Lewis,	—
Hazelton Tripod Boiler Co.	24
Hutchison, W. S.	26
Harrington & King Perforating Co.	18
*Hodell, H. H. & Co.	—
Hartford Steam Boiler Insp. & Ins. Co.	22
Hackney Hammer Co	15
Hartman Sliding Blind Co.	22
Hercules Powder Co	24
*Holbrook & McDonald	17
*Indiana Machine Works	—
Iron Clad Paint Co.	25
Industry File Works	26
Jones, E. H. & Co	24
Jeffrey Mfg. Co	20
Jenks, James	18
Kanneberg Roofing Co.	25
*Leffel, Jas. & Co	25—
*Long Steel & Iron Roofing Co	25
*Leffel Water Wheel & Engine Co	—
Ladd, Alfred W.	23
Murdock, James, Jr.	22
Milton Mfg. Co.	15
*Munn & Co.	6
*McCombs, C. E.	—
Michigan Emery Wheel Co.	16
Millers Falls Co	26
*Neracher Sprinkler Co.	—
New Philadelphia Iron & Steel Co.	18
*Niles Iron & Steel Roofing Co.	—
Outhwaite, J. H. & Co.	19
Oglebay, Norton & Co.	19
Oldfield, L. H.	22
Pope, E. C	19
Parkin & Bosworth Co.	26
Palmer, Cunningham & Co	20
Pittsburgh & Wheeling Coal Co.	19
Penberthy Injector Co	26
Pollock, Wm. B. & Co.	24
Rogers & Hubbard Co	20
Rowell, Geo. P. & Co.	16–18
Reynolds Bros.	26
Schleicher, Schumm & Co.	24
Sykes Iron Roofing Co.	25
Sackman, F. A	20
Southwark Foundry & Machine Co.	25
Stirling Co.	15
Stilwell & Bierce Mfg. Co.	26
Spicer Mfg. Co.	15
Shepard, H. L., Agent	15
Skinner Engine Co.	25
Stevens, F. B.	25
Satterthwaite, M. P	21
*Simpson, Thos. P.	—
Sterling Grate-Bar Co.	20
Toledo Machine & Tool Co.	24
Tod, Wm. & Co.	24
Totten & Hogg Iron & Steel Foundry Co.	15
Van Duzen Gas Engine Co.	22
Upson Nut Co.	22
Union Electrotype Foundry	20
Universal Radial Drill Co.	26
Unger & Wigham	18
Union Photo Engraving Co.	25
Webster, Warren & Co.	15
Webster, Camp & Lane Machine Co.	20
West, Thos. D. Foundry Co.	20
Westinghouse Machine Co.	25
Wyckoff, Seamans & Benedict	18



VICTOR COLLIAU,

Sole Manufacturer of the

Improved Patent

HOT BLAST

COLLIAU CUPOLA

ADDRESS:

287 Jefferson Ave.,

DETROIT, - MICH.

THE NEW PHILADELPHIA IRON AND STEEL CO.

MANUFACTURERS OF

SHEET IRON AND SHEET STEEL

FOR Roofing, Galvanizing AND ALL OTHER PURPOSES.

N.P.I.&S.CO.

N.P.

REFINED

TRADE MARK

OFFICE AND WORKS

NEW PHILADELPHIA, OHIO.

TYPEWRITERS.

THE REMINGTON STANDARD TYPEWRITER

Is to-day, as it has ever been, the leading Typewriter.

Carefully tested improvements are constantly added to this famous machine.

TRY OUR PARAGON BRAND OF TYPEWRITER RIBBONS.

WYCKOFF, SEAMANS AND BENEDICT,

137 Superior St., Cleveland, O.

A SPLENDID CHANCE

TO ESTABLISH YOURSELF IN A

Good Paying Business.

I have for sale a small MACHINE SHOP with good Tools, now manufacturing specialties and a good jobbing trade offered. LOW RENT. Can work into a big business Call on or address

JAMES JENKS.

Dealer in Machinery, DETROIT, MICH.

FOR SALE.

Manufacturing Site

ON CANAL ST., CLEVELAND,

Adjoining White Sewing Machine Co.'s Plant. About 67 ft front extending back to Valley R. R. tracks. For particulars address

B. M. GARDNER,

CARE IRON TRADE REVIEW

Advertising.

IF you wish to advertise anything anywhere at any time write to GEO. P. ROWELL & CO., No. 10 Spruce St., New York.

EVERY one in need of information on the subject of advertising will do well to obtain a copy of "Book for Advertisers," 368 pages, price one dollar. Mailed, postage paid, on receipt of price. Contains a careful compilation from the American Newspaper Directory of all the best papers and class journals; gives the circulation rating of every one, and a good deal of information about rates and other matters pertaining to the business of advertising. Address ROWELL'S ADVERTISING BUREAU, 10 Spruce St., N. Y.

DON'T USE poor printing when you can get the best at the same prices, of the CLEVELAND PRINTING & PUBLISHING CO., Cleveland, O.

THE HARRINGTON & KING PERFORATING CO.

MANUFACTURERS OF PERFORATED METALS FOR SUGAR HOUSES, DISTILLERIES, PHOSPHATES AND FERTILIZING WORKS

COTTON SEED OIL MILLS. RICE MILLS.

PERFORATED METALS

ELEVATORS, MALT KILN FLOORS, GRAIN DRYERS, SEPARATORS, CORN SHELLERS AND ALL KINDS OF GRAIN CLEANING MACHINERY; ALSO, FOR MINING AND CONCENTRATING WORKS: COAL, COKE AND ORE SCREENS

GAS AND WATER WORKS; PAPER, WOOLEN, FLOUR AND OIL MILLS; FILTERS, STRAINERS, VENTILATORS, ETC. HEAVY STEEL AND IRON PLATES AND CYLINDERS FOR SCREENING ORE, COAL, STONE, PHOSPHATES, ETC. REVOLVING SCREENS, ROUND AND HEXAGON, GRIZZLIES FOR PLACER MINING, STAMP BATTERY SCREENS OF ALL KINDS AND SIZES. MINING SCREENS FOR ALL KINDS OF ORES. SPECIAL ATTENTION GIVEN TO WORK FOR RAILROADS AND CAR BUILDERS. PERFORATED TIN AND BRASS OF ALL SIZES.

MAIN OFFICE AND WORKS

224 & 226 NORTH UNION ST CHICAGO, ILL. U.S.A.

PERFORATED BRASS. PERFORATED TIN.

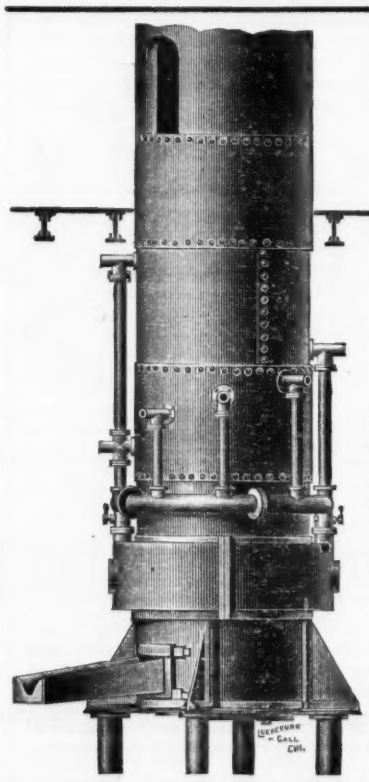
284 Pearl St. cor. Beekman, NEW YORK.

COPELAND & BACON.

HOISTING & WINDING ENGINES

ORE CRUSHERS, ORE WASHERS, CONCENTRATING MACHINERY, GRAVITY INCLINES, STONE CRUSHERS, RAILROAD CRANES.

85 LIBERTY ST., NEW YORK. 535 ARCH ST., PHILADELPHIA



THE GREINER

Patent Economical

CUPOLA.

15 to 50 Per Cent. Saving in Fuel,

With Corresponding Increase in Quality of Iron Melted, Over any Existing Cupola.

15 Per Cent Saving Guaranteed.

Can be Applied to any Type of Cupola Now in Use.

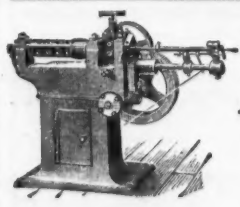
400 IN USE IN EUROPE.

U. S. REFERENCES GIVEN.

AGENTS WANTED.

UNGER AND WIGHAM,

301 Phenix Building, Chicago.

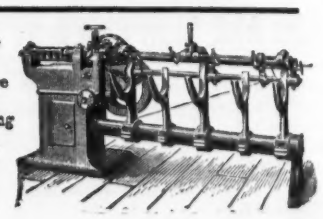


JOHN ADT & SON,

New Haven, Conn.

Builders of Machinery for Hardware Manufacture.

Automatic Wire Straightening and Cutting Machines, Butt Milling Machinery, Butt Drilling Machinery, Riveting Machines, Foot Presses, Sprue Cutters, Etc.



CATALOGUES

Printed in the Highest Style of Art, by
The Cleveland Printing & Publishing Co.,
Cleveland, O.

CLEVELAND ROLLING MILL CO.,

MANUFACTURERS OF

BESSEMER STEEL RAILS,

Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel. Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, net cash) Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1 foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 25@16 00; Southern Coke No. 3 Foundry, $14 75@15 50; Southern Coke No 1, Softeners, $15 25@16 00; Southern Coke No. 2, Softeners, $14 50@15 25; Ohio Silveries No. 1, $17 50@18 50; Ohio Silveries No. 2, $16 50@ 17 50; Ohio Strong Softeners No. 1, $18 00@19 00; Ohio Strong Softeners No. 2, $17 25@18 25; Lake Superior Charcoal Nos. 1 to 6, $17 75@18 50; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 00@18 00; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $14 75@15 00; Southern coke, No. 2 and No. 1 soft, $13 75@$14 25; Hanging Rock Coke No. 1 foundry, $16 50@17 00; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $17 00@17 50; Hanging Rock Charcoal, No. 1 foundry, $17 75@21 00. MILL IRONS—Standard Southern Coke, grey forge, $12 75@13 00; Standard Southern Coke, mottled, $12 50@12 75; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $19 50@20 50; Tennessee Car Wheel, $18 00@19 00; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co): Mahoning and Shenango Valley strong, No. 1 Foundry, $16 00@00 00; Mahoning and Shenango Valley strong, No. 2 Foundry, $15 00@00 00; Ohio Softener No. 1, $16 25@00 00; Ohio Softener No. 2, $15 25@00 00; Jackson Co., Silvery No. 1, $18 00@00 00; Jackson Co. Silvery, No. 2, $17 00@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $18 00@19 00; Southern Softener No. 1, $16 25@00 00; Southern Softener No. 2, $15 50@15 75; Southern Strong No. 1 Foundry, $16 75@00 00; Southern Strong No. 2 Foundry, $16 25@00 00' Alabama Car Wheel, $19 75@21 75; Hanging Rock Char coal, $21 00@22 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 50@14 00; Southern coke No. 3, $13 00@13 25; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 00@17 00; Southern charcoal, No. 2, $15 50@16 00; Missouri charcoal, No. 1, $17 00@17 50; Missouri charcoal, No. 2, $16 50@17 00. FORGE—Neutral coke, $12 50@12 75; Cold short, $12 25@12 50; Mottled, $11 75@12 00 CAR WHEEL AND MALLEABLE—Southern (standard brands), $19 00@19 50; Southern (other brands), $17 00@18 00; Lake Superior, $20 00@21 00.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@15 75; Southern Coke No. 2, $14 50@14 75; Southern Coke No. 3, $13 75@14 25; Southern Grey Forge, $13 25@13 50; Southern Charcoal No. 1, $17 25@17 75; Southern Charcoal No. 2, $16 75@1 25; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $19 50@20 00; Southern, $19 50@2 00 CONNELLSVILLE COKE—East St. Louis, $0 00 St. Louis, $5 65.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $17 50@18 00; Lake Superior (coke) Bessemer, $16 50@17 00; Katahdin (Maine charcoal), $00 00@00 00; Lake Superior Coke, Foundry, all ore, $17 50@18 00; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $16 25@16 50; Southern Gray Forge, $14 00@14 50, Jackson County (Ohio) Silvery, $18 25@18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0.00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 50@15 00, Southern Coke No. 2 Foundry $13 50@14 00; Southern Coke No. 3 Foundry $13 00@13 50; Grey Forge, $12 50@13 00; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $18 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $15 50@16 00; No. 2 Foundry, $14 50@15 00; Grey Forge, $13 50@13 75; White and Motiled, $13 00@13 25; Warm Blast Charcoal, $18 00@22 00; Cold Blast Charcoal, $22 00@26 00; Bessemer, $15 00@15 25.

MERCHANT IRON AND STEEL.

Flat Bar

1½ to 4 by ⅛ to 1 inch	1 70
4½ to 6 by ⅛ to 1 inch	1 85
1½ to 6 by 1¼ to 2 inch	2 15
1½ & 1¾ by ½ to ¾ inch	1 85
1 & 1¼ by ⅛ to ¾ inch	1 95
⅛, ¼ and ⅜ by ⅛ to ½ inch	2 15

Round and Square.

1 to 1⅞ inch	1 75
2 to 2¾ inch	1 95
2¾ to 3¾ inch	2 25
3½ to 4 inch	2 75
4¼ to 4¾ inch	3 25
4¾ to 5 inch	3 45

Ova

¼ to 1¼ inch	1 15
⅛ to ¾ inch	2 25
⅜	2 55
½	2 95

Half Oval and Half Round.

⅜ to 3 inch	2 85
⅜ to 1¼ inch	2 45
½ to ¾ inch	3 05
⅝	3 25
¾	4 75

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	1 55
¼ to 1½ by ¼ and 5-16 inch	2 05
⅜ to ½ by ¼ and 5-16 inch	2 25
⅜ to ½ by ½ and 5-16 inch	3 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 55
1¼ to 2, Nos. 16 to 18	2 65
1¼ to 2, No. 19	2 75
1¼ to 2, No. 20	2 85
1¼ to 2, No. 21	2 95
1¼ to 2, No. 22	3 05
15-16, 1 and 1⅛, Nos. 13 to 15	2 75
15-16, 1 and 1⅛, Nos. 16 to 18	2 85
15-16, 1 and 1⅛, Nos. 19 and 20	2 95
15-16, 1 and 1⅛, No. 21	3 05
15-16, 1 and 1⅛, No. 22	3 15
⅞, Nos. 13 to 15	2 95
⅞, Nos. 16 to 18	3 05
⅞, Nos. 19 and 20	3 15
⅞, No. 21	3 25
⅞, No. 22	3 35
13-16, Nos. 13 to 15	3 15
13-16, Nos. 16 to 18	3 25
13-16, Nos. 19 and 20	3 35
13-16, No. 21	3 45
13-16, No. 22	3 55
¾, Nos. 13 to 15	3 25
¾, Nos. 16 to 18	3 45
¾, Nos. 19 and 20	3 55
¾, No. 21	3 65
¾, No. 22	3 75
11-16, Nos. 13 to 15	3 55
11-16, Nos. 16 to 18	3 65
11-16, Nos. 19 and 20	3 75
11-16, No. 21	3 85
11-16, No. 22	3 95
⅝, Nos. 13 to 15	3 75
⅝, Nos. 16 to 18	3 95
⅝, Nos. 19 and 20	4 05
⅝, No. 21	4 15
⅝, No. 22	4 25
⅝, No. 23	4 45

Light Band.

1¾ to 6 by ⅛ to 3-16 in	2 20
1¾ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅞ and 13-16 by ⅛ to 3-16 in	2 70
⅞ and 1 3-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ⅛ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ⅛ to 3-16 in	3 30
⅝ and 9-16 by Nos. 11 and 12	3 40
½ by ⅛ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	3 80
⅜ inch, " " " 13 and 14	3 00
¼ inch, " " " 11 and 12	3 10
¼ inch, " " " 13 and 14	3 30

Sheet Iron.

No. 10 to 14	2 45
No. 15 to 17	2 55
No. 18 to 21	2 75
No. 22 to 24	2 85
No. 25 to 26	2 95
No. 27	3 25
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1 " "	2 50
C H Flange, " "	3 10
Extra Flange, "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅛c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s
1 to 2 in. inclusive	08
9-16 to ⅞ in "	08½
7-16 to ⅝ and 2⅝ to 3 in	09
3⅛ to 4 in	09½
⅜ to 11-16 and 4⅛	10
⅛ to 6 in	10⅛
¼ to 9-32 and 6⅛ to 7 in	11
3-6 in	13

Flats.

	cts. ℔s
2 to 9-16 wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery	base price.	2 35
Tire	"	2 25
Spring	"	2 80
Sleigh Shoe	"	2 50
Toe Calk	"	2 35
Cutter Shoes, tapered and burr.	"	2 75

English Tool Steel.

Jessop's	15½
Hobson's "Best"	15½ c
" "Choice"	15

Burden Boiler Rivets.

⅜, ½, 11-16 and ⅝ inches diameter	4 00
Bridge ⅜, ½, 11-16 and ⅝ inch diam	4 00

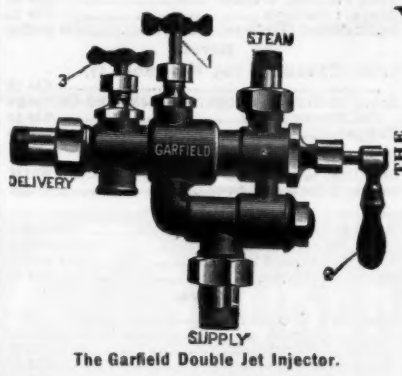
SCRAP IRON AND OLD METAL.

NET TONS	
No. 1 R. R. wrought scrap	$18 00
No. 1 wrought scrap	16 50
No. 1 Machine cast scrap	11 50
Iron axles	23 50
Axle turnings	13 50
Wrought turning (free from cast)	11 50
Cast borings	8 00
Uncut wrought iron boilers	11 50
Steel boiler plates	16 00
Grate Bars	8 00
Pipes and flues (Clean)	12 00
Tank iron	12 50
Hoop and band iron	9 50
Sheet iron	8 50
Wrought drillings	11 00
Malleable iron	9 50

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	10 00

THE GARFIELD INJECTOR CO.,



The Garfield Double Jet Injector.

WADSWORTH, O.,
—MANUFACTURERS OF—
THE GARFIELD
Locomotive Injector,
Automatic Injector,
Double Jet Injector
AND
Ejector.

Strong, Carlisle & Turney,
General Agents,
CLEVELAND, O.

PITTSBURGH & WHEELING COAL CO.,
MINERS AND SHIPPERS OF
Ohio Steam Coal and Coke.
Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.
Office, 6 Mercantile Bank Building.
CLEVELAND, OHIO.
Lake Shipping Point, Lorain O
JAS. PATTERSON, Sales Agent.

CORRICAN, IVES & CO.,
DEALERS IN
Iron Ore & Pig Iron,
Rooms 716, 717, 718, 719 Perry-Payne Bld'g.
CLEVELAND, O

OGLEBAY, NORTON & CO.,
Successors to Tuttle, Oglebay & Co.,
Commission Dealers in
Iron - Ores,
FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,
CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.
J. H. OUTHWAITE & CO.,
Exclusive attention given to
LAKE SUPERIOR AND MENOMINEE RANGE
Iron Ore,
Perry-Payne B'ld'g. Cleveland, O.

THE CONDIT-FULLER CO.,
Pig and Bar Iron,
CLEVELAND, OHIO

E. C. POPE,
COMMISSION DEALER IN
Iron Ore, Pig Iron
AND METALS.
Cleveland, - Ohio.

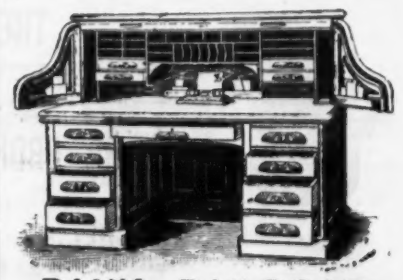
Sam'l. L. Matnei, Prest. & Treas. Fred. A. Morse, Sec'y.
Cleveland Iron Mining Co.,
Dealers in Iron Ores
from their own mines near Marquette, Lake Superior.
Rooms 4 & 5 Mercantile Bank Building,
CLEVELAND O.

BOSTWICK PATENT.

A great saving in mortar, material and labor
Write for Catalogue and Sample.
THE BOSTWICK STEEL LATH CO.,
38 Park Row, New York City. Niles, O
Mention this Paper.

ESTABLISHED 1854.
PETER GERLACH & CO.,
MAKERS OF
Saws, Tools and Machinery.
Office and Warerooms, 28 Columbus st.
Factories on Columbus, Winter and Leonard streets.
Cleveland, O., U. S. A.

DESKS.



BANK, RAILROAD
—AND—
OFFICE + FURNITURE.
Interior Work a Specialty.
Send for Illustrated Catalogue.
THE CLEVELAND DESK CO.
97-99 Ontario St., • • Cleveland, Ohio.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40
Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 30
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3¼

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¼".....dis 50&10
Morse Taper and Straight shank Larger than 1¼".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¾c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
6 lb cans, 10 in case	6 c	6¾c		5 c
6 lb cans, less than 1	10 c	10 c		7¼c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	2¾	2⅛
Hexagon	15⅜	11⅛	8⅛	6	5⅛	5⅜	5
Washers	9	8	7	5	4⅜	4⅜	4⅜

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 { Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¾ inch and over.....₩ lb 15½
Sisal, ¾ inch and over .....₩ lb 13½

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 30
Atkins' Cicular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 33c "
No. 1 Handles.....dis 25c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay .....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 65
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅜ ₩ Balls	21c@29c	
No. 18 " " ¼ and ⅜ "	18c@28c	
No. 36 " " ¼ and ⅜ "	16c@27c	
2-Ply Hemp, ¼ & ⅜ ₩ Balls (Spring Twine	11¼c	
3-Ply " 1lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 25

Wire.

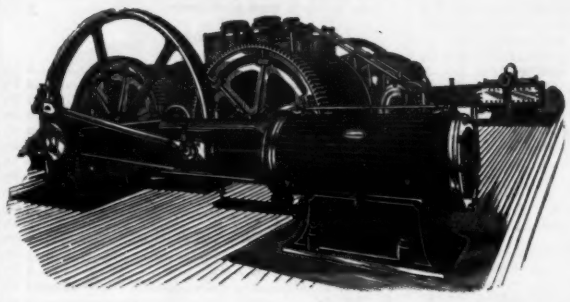
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70@10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$7.00@D dis 1

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 5
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



MANUFACTURERS OF

Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves. Cages, Buckets, Etc.

Send for Catalogue D. 134 N. Main St., AKRON, OHIO.

AMERICAN BRIDGE AND IRON CO.,

Roanoke, - - Va.,

Designers and Builders of

IRON AND STEEL BRIDGES AND VIADUCTS FOR HIGHWAYS AND RAILROADS,

Iron Furnace Plants, Stand Pipes, Mine Car Irons and Wheels,

Also Machinists and Founders. ENGINEERS: C. C. Wentworth and Jos. L. Hunter.

THE STERLING CRATE-BAR COMPANY,

—MANUFACTURERS OF—

The Celebrated Sterling Crate-Bar.

The most economical, the most durable and the easiest of management. Made of cast iron or annealed cast steel, either stationary or with shaking attachment. Prices quoted on all kinds of bars. General offices,

SOCIETY FOR SAVINGS BUILDING, - - CLEVELAND, O.

THE THOS. D. WEST FOUNDRY, CO.

CLEVELAND, O.

LIGHT AND HEAVY

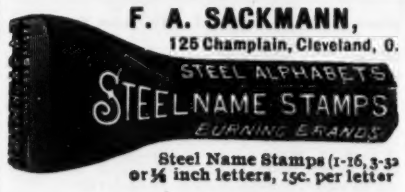
IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS-SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY

F. A. SACKMANN,

125 Champlain, Cleveland, O.

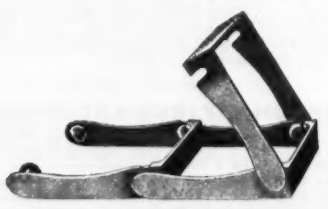


Steel Name Stamps (1-16, 3-32 or ¼ inch letters, 15c. per letter

Chain Belting

OF VARIOUS KINDS.

MALLEABLE, STEEL, WROUGHT AND SPECIAL.



SEND FOR

REDUCED PRICE LIST.

THE JEFFREY MFG. CO.,

143 E. First Ave., Columbus, O.

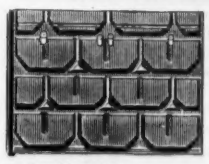
Chicago Branch, - - 48 So. Canal St.

New York Branch, 15 Cortlandt St.

Eastlake Metallic Shingles.

Unequaled for

ROOFING AND SIDING.



Manufactured by

W. J. BURTON & CO.'s

Galvanized Iron Cornice Works,

Detroit, Mich.

Send for illustrated catalogue and prices.

Mention this paper.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2139

829 SHERIFF ST. CLEVELAND O.

THE INDISPENSABLE LATHE DOG.

THE INDISPENSABLE LATHE DOGS can be attached to work after the work is centered in the lathe. They can be used equally as well BETWEEN COLLARS as upon plain or straight work.

DROP FORGED FROM BAR STEEL.

No. 1 takes from ¼ to 1⅛ inches, price, each.....$1 50
" 2 " ⅛ to 2⅛ " " 2 50
" 3 " 1 to 3¼ " " 3 50
Price, per set of three, to take from ¼ to 3¼ in. 7 50

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

GRANULATED RAW BONE

For Case Hardening and Coloring

For samples, prices, etc., apply to

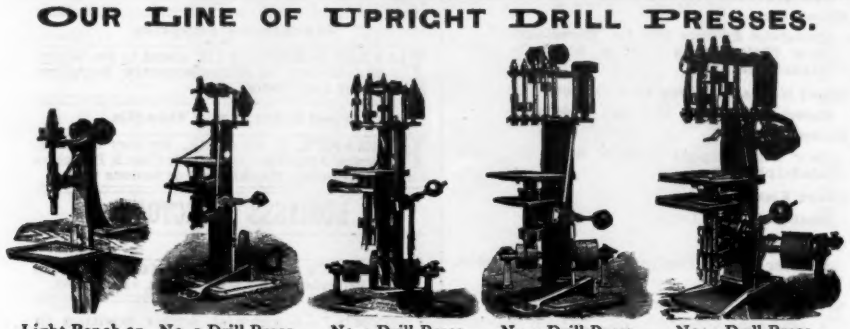
THE ROGERS & HUBBARD CO., Middletown, Ct.

PATENTS

For INVENTORS. 40-page BOOK FREE. Address W. T. Fitzgerald, Att'y at Law, Washington, D.C.

ELECTRIC LIGHT PLANTS
FOR STEAM SHIPS · WAR SHIPS · STEAM BOATS · YACHTS · FERRY BOATS ETC
SEARCH LIGHTS OF MOST APPROVED PATTERN
MOTORS AND DYNAMOS FOR USE ON SHIPBOARD
EDISON GENERAL ELECTRIC CO.
EDISON BUILDING BROAD ST. NEW YORK

OUR LINE OF UPRIGHT DRILL PRESSES.



Light Bench or Post Drill. | No 1 Drill Press. 1 or 2 Spindles. | No. 2 Drill Press. | No. 3 Drill Press. | No. 4 Drill Press.

THE GARVIN MACHINE COMPANY

Manufacturers of, and Dealers in, all kinds of

Machinery and Machine Tools.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines, Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, etc.

Plants for Manufacturers of Sewing Machines and Electrical Goods.

GEAR CUTTING AND MILLING IN ALL ITS BRANCHES.

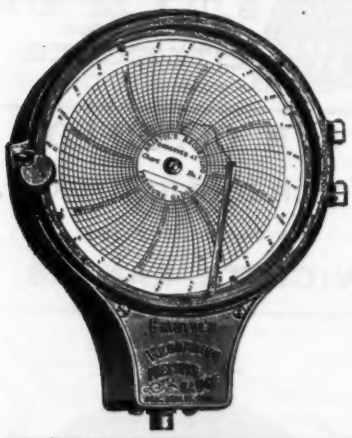
Laight & Canal Sts., [Catalogue sent on Application] **NEW YORK.**

HAS YOUR WAREROOM BEEN ROBBED?

Our corrugated or plain Iron or Steel **SHUTTERS** and **DOORS** will render it Fire and Burglar Proof. We also cover wooden shutters and doors with flat painted sheets, either plain or with corduroy corrugations. For prices, etc., address

The Cincinnati Corrugating Company,

BOX 320. **PIQUA, O.**



Bristol's Recording

PRESSURE GAUGE

Makes a continuous record day and night of Steam, Water, Gas or Air Pressure.

Simple, Reliable and Cheap.

HUNDREDS IN USE.

Will send on 30 days trial. Address

M. P. SATTERTHWAITE,

237 Bank St., - - CLEVELAND, O.

DIXON'S GRAPHITE PAINT

THOSE who use it say that one pound will cover 2 to 3 times more surface and last 4 to 5 times longer than any lead, mineral or metallic paint. A tin or iron roof well painted will not require repainting for 10 to 15 years.

JOS. DIXON CRUCIBLE CO.,
Jersey City, N. J.

STEEL CASTINGS

FROM 1-4 TO 15,000 LBS. WEIGHT.

True to pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position, or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel, now running, prove this.
Crossheads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for circulars and prices to

CHESTER STEEL CASTINGS CO.,

WORKS: CHESTER, PA. | OFFICE: 407 LIBERTY ST., PHILADELPHIA, PA.

FREIGHT AND PASSENGER

ELEVATORS.

L. S. GRAVES & SON,

Main Office and Works, ROCHESTER, N. Y.

BRANCH OFFICES:

NEW YORK, 92 and 94 Liberty St.; BOSTON, 113 Devonshire St.; St. LOUIS, 301 Roe Building; DETROIT, Hodges Building.

SEND FOR CATALOGUE.

OFFICE, 510---265 to 269 DEARBORN ST
WORKS AT SOUTH CHICAGO.

MANUFACTURERS OF

Iron, Glass, Hardwood, Lumber,

Desiring a location where Coal, Gas and Oil are an object as fuel, Railroad facilities unsurpassed, in one of the most thriving cities in Western Pennsylvania, and where liberal inducement is made regarding land plant, should address

W. W. BROWN.

Pres. Board of Trade,

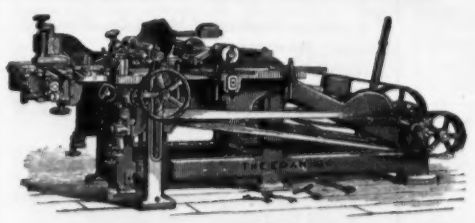
BRADFORD, PA.

THE EGAN CO.,

Nos. 251 to 271 W. Front St., CINCINNATI, OHIO.

Builders and Originators, Designers and Constructors.

Wood-Working Machinery.



New "Standard Molder, Four Sided.

4, 6, 7, 8, 9, 10 and 12-inch.
Geared feed rolls, two above and two in table. Slotted steel heads.

For Every Purpose
Meeting the requirements of
PLANING MILLS,
SASH, DOOR and BLIND FACTORIES
PATTERN SHOPS,
General Wood-workers etc.

With the latest and most advanced type of machines for fast and perfect work.

Catalogue and information

BUYERS' DIRECTORY OF IRON AND STEEL TRADES.

Automatic Sprinklers—
Neracher Sprinkler Co., Warren, O.

Advertising Agencies—
G. P. Rowell, New York.

Barbed Wire Fence—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland.

Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York.
Wm. B. Pollock & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
Hazelton Tripod Boiler Co., Chicago.
The Stirling Co., Barberton, O.
Chandler & Taylor Co., Indianapolis, Ind.
Skinner Engine Co., Erie, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Leffel Water Wheel & Engine Co, Springfield, O.
James Leffel & Co., Springfield, O.
Chas. Miller, Beaver Falls, Pa.

Blowers—
C. E. McCombs, Cleveland.
E. H. Jones & Co., Cleveland.

Boiler Solvents—
Dearborn Drug & Chemical Co., Chicago, Ill

Blowing Engines—
The James Leffel & Co., Springfield, O.
Southwark Foundry & Machine Co., Philadelphia, Pa

Bridges—
American Bridge & Iron Co., Roanoke, Va.

Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Craig, Ridgway & Son, Coatesville, Pa.

Chain Belting—
Jeffrey Mfg. Co., Columbus O.

Civil Engineers and Architects—
F. Felkel, Cleveland, O.

Cupolas—
Victor Colliau, Detroit, Mich.
Unger & Wigham, Chicaeo, Ill.

Corrugated Steel—
Cincinnati Corrugating Co., Piqua, O.

Drilling Machines—
Universal Radial Drill Co., Cincinnati, O.

Drop Presses—
Toledo Tool & Machine Co., Toledo, O.

Desks—
Cleveland Desk Co., Cleveland.

Elevators—
L. S. Graves & Co., Rochester, N. Y.

Explosives—
Hercules Powder Co., Cleveland.

Electrical Manufactures—
Edison General Electrical Co., N. Y.
Gillette & Lewis, Cleveland.
Barr Electric Mfg. Co., New York.

Emery Wheel Machinery—
I. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.

Emery and Corundum Wheels—
Michigan Emery Wheel Co., Detroit, Mich.

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland.
Union Electrotype Foundry, Cleveland.

Engines (Steam)
Chandler & Taylor Co., Indianapolis, Ind.
Wm Tod & Co., Youngstown, O.
E. H. Jones & Co., Cleveland,
Buckeye Engine Co., Salem, O.
Skinner Engine Co., Erie, Pa.
Westinghouse Machine Co., Pittsburgh,
Southwark Foundry & Machine Co, Philadelphia, Pa.
Leffel Water Wheel & Engine Co., Springfield, O.
Totten & Hogg, Pittsburgh, Pa.
Webster, Camp, & Lane Machine Co., Akron.
James Leffel & Co., Springfield, O.

Engines (Gas)—
Schleicher, Schaumm & Co., Philadelphia, Pa. and Chicago, Ill.
Van Dusen Gas Engine Co., Cincinnati, O.

Engineers and Contractors—
E. H. Jones & Co., Cleveland.
F. Felkel, Cleveland.
Gillette & Lewis, Cleveland.

Ejectors—
James Jenks, Detroit, Mich.

Engineers' Specialties—
Butman Furnace Co., Chicago, Ill.

Files, Makers of—
Reynolds Bros., Columbus, O.
A. & H. Gough, Cleveland.
Parkin & Bosworth Co., Cleveland.

Forges—
Cleveland City Forge & Iron Co., Cleveland.

Foundries—
Thos. D. West. Foundry Co., Cleveland.
Canton Iron Foundry Co., Canton, O.
Spicer Mfg. Co, New Philadelphia, O.
Harn, Ow, & Co., Beaver Falls, Pa.
American Bridge & Iron Co., Roanoke, Va.

Flue Cleaners—
Butman Furnace Co., Chicago, Ill.

Fire Brick Clay—
F. B. Stevens, Detroit, Mich.

Foundry Supplies—
F. B. Stevens, Detroit, Mich.

Gear Cutters—
Palmer, Cunningham & Co., Philadelphia, Pa.

Galvanizers.
H. H. Hodell, Cleveland.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City.

Granulated Raw Bone—
The Rogers & Hubbard Co., Middletown.

Heating Apparatus—
C. E. McCombs, Cleveland.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O.
E. H. Jones & Co., Cleveland.
Warren Webster & Co., Philadelphia Pa.

Hammers (Power)—
Hackney Hammer Co., Cleveland.

Harness Specialties—
Buffalo Specialty Co., Buffalo, N. Y.

Hack Saw—
Millers Falls Co., New York.

Insurance Companies—
Hartford Steam Boiler Co., Hartford, Ct.

Investments—
Muskegon Improvement Co., Muskegon.
W. W. Brown, Bradford, Pa.
Alfred W. Ladd, New York.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Cambridge Iron Roofing Co., Cambridge, O.
Garry Iron Roofing Co., Cleveland.
Berger Mfg. Co., Canton, O.
Eberts Bros., Detroit, Mich.
Kanneberg Roofing Co., Canton, O.
The Long Steel & Iron Roofing & Corrugating Co., Indinapolis.
W. J. Burton & Co., Detroit, Mich.
Niles Iron & Steel Roofing Co., Niles, O.
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Iron Ore, Bar and Pig Iron—
Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland, O.
E. C. Pope, Cleveland.
Cleveland Iron Mining Co., Cleveland.
Corrigan, Ives & Co., Cleveland.

Injectors—
Penberthy Injector Co., Detroit, Mich.
Garfield Injector Co., Wadsworth, O.

Lathes—
H. L. Shepard, Cincinnati, O.
Parkin & Bosworth Co., Cleveland.

Lathe Dogs—
Palmer, Cunningham & Co., Philadelphia.

Lathe Tools—
Armstrong Bros., Chicago, Ill.

Mining Machinery—
Webster, Camp & Lane Machine Co., Akron, O.
Copeland & Bacon, New York.
American Bridge & Iron Co., Roanoke, Va.

Machine Shops—
Webster, Camp, & Lane Machine Co., Akron, O.
Toledo Machine & Tool Co., Toledo, O.
Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow, & Co., Beaver Falls, Pa.
American Bridge & Iron Co., Roanoke, Va.

Machinists' Tools and Supplies—
Parkin & Bosworth, Co., Cleveland.
Garvin Machine Co., New York.
M. P. Satterthwaite, Cleveland.
Armstrong Bros., Chicago, Ill.

Metal Ceilings—
Fred F. Bischoff, Chicago, Ill.

Merchandise Brokers—
L. H. Oldfield, Wichita, Kan.

Metallic Shingles—
W. J. Burton & Co., Detroit, Mich.

Manufacturing Sites—
Muskegon Improvement Co., Muskegon.
W. W. Brown, Bradford, Pa.

Moulding Sand—
F. B. Stevens, Detroit, Mich.

Motors and Dynamos—
Edison General Electrical Co., New York.
Gillet & Lewis, Cleveland.

Machinery—
M. P. Satterthwaite, Cleveland

Natural Gas Specialties—
A. Harvey's Sons Mfg. Co., Detroit, Mich.

Patents—
Munn & Co., New York.
W. T. Fitzgearld, Washington, D. C.
Thos. P. Simpson, Washington, D. C.

Pumps (Steam)—
E. H. Jones & Co., Cleveland.
Deming Co., Salem, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago Ill
Aitchison Perforated Metal Co., Chicago.

Power Hammer—
Hackney Hammer Co., Cleveland.

Powder Mining Machinery—
Hercules Powder Co., Cleveland.

Pressure Gauges—
M. P. Satterthwaite, Cleveland.

Photo Engravings—
Union Photo Engraving Co., Cleveland.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Rock Breakers and Ore Crushers—
Totten & Hogg, Pittsburgh, Pa.

Rolls and Pinions—
Totten & Hogg Iron & Steel Foundry Co., Pittsburgh, Pa.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Saws—
Peter Gerlach & Co., Cleveland.

Search Lights for Vessels—
Edison General Electrical Co., New York.

Second Hand Machinery—
Parkin & Bosworth Co., Cleveland.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.
F. A. Sackman Cleveland, O.
Jas. Murdock Jr., Cincinnati, O

Sheet Iron—
Cleveland Rolling Mill Co Cleveland.
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.

Sheet Steel—
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Steel Laths—
Bostwick Steel Lath Co., Niles, O.

Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa

Steam, Gas and Plumbers Supplies—
A. Harvey's Sons Mfg. Co., Detroit Mich.

Smoke Consumers—
C. O. Arey, Cleveland.

Twist Drills—
Cleveland Twist Drill Co., Cleveland.
Graham Twist Drill Co., Detroit, Mich.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Typewriters—
Wyckoff, Seaman & Benedict, Cleveland.

Ventilating Fans—
C. E. McCombs, Cleveland.
E. H. Jones & Co., Cleveland.

Water Gas Furnaces
W. S. Hutchinson, Chicago, Ill.

Window Blinds—
Hartman Sliding Blind Co., Wooster, O.

Wire Goods—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Wood-Working Machinery—
Indiana Machine Work. Ft. Wayne, Ind.
Frank & Co., Buffalo, N.Y.
The Egan Co., Cincinnati, O.

Wire Machinery—
John Adt & Son, New Haven, Conn.

Wire Nails—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Washers—
Milton Mfg. Co., Milton, Pa.

At Receiver's Sale.

WOOD AND IRON WORKING PLANT in running order, everything complete. A large established trade on a patented article, saleable at all seasons, goes with plant. Can be purcaased at a bargain. For particulars, address E. P. C., Receiver, Warren, O.

For Sale.

ALL or part of well established machine shop and foundry, owning gas well in a growing gas city. Address A. G., care IRON TRADE REVIEW.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President
B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

A. S. FERRY, Gen'l Agt., 208 Superior Street, Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
R. D. BRIGGS, Special Agt., 208 Superior St., Cleveland, O.
J. E. WOLCOTT Special Agent, 208 Superior St., Cleveland, O.
L. C. BURWELL, Special Agent, 81 4th Ave., Pittsburgh, Pa.

CLEVELAND BUSINESS DIRECTORY.

F. FELKEL,
CIVIL ENGINEER AND ARCHITECT,
155 ST. CLAIR ST., CLEVELAND, O.
IRON BUILDINGS, LARGE SPAN ROOFS
PLANS for Manufacturing Plants, Warehouses andother Heavy Structures a SPECIALTY.

Bolt and Nut Works.

THE UPSON NUT CO, Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Hardware and Iron.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

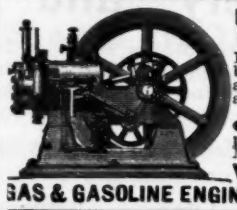
BUSINESS DIRECTORY.

Akron, O.

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main st.

CHEMIST—A chemist wants position in iron or steel works, or at ore mines. Address L. P. N., Iron Trade Review.

GAS and GASOLINE ENGINES
STATIONARY and PORTABLE. All Sizes.



Dwarfs in Size, but Giants in Strength.
Expense one cent an hour per horse power and requires but little attention to run them.
Every Engine Guaranteed. Full particulars free by mail Mention this paper.
VAN DUZEN GAS & GASOLINE ENGINE CO. Cincinnati, O.

Bischoff Metal Ceilings,
(PATENTED.)

It will pay to investigate and write for catalogue.
Estimates submitted on application.
Fred. F. Bischoff & Co.
24 W. Lake St.,
CHICAGO. - ILL.

JAS. MURDOCK, JR.
Manufacturer of
STEEL STAMPS
NAME PLATES,
& TIME & TOOL ROOM CHECKS.
NILES TOOL WORKS 25
52 Longworth St. Cincinnati. O

L. H. OLDFIELD.
Merchandise Broker.
Correspondence Solicited.
WICHITA, KANSAS.

Tens of thousands of these blinds are in use. Agents wanted; Send 4-cent stamp for an 80-page illustrated catalogue to
HARTMAN SLIDING BLIND CO.,
89 Beaver St. WOOSTER O., U. S. A.

BARR ELECTRIC MANUFACTURING CO.,

(Incorporated under the Laws of the State of New York.)

17 and 19 Broadway, New York.

This illustration represents our Electric Lighter. It is complete in itself—requires no extra Power Works or Connections. The current of electricity is generated by chemical action. It occupies the space of but Six Square inches. The construction is simple in the extreme. It can be taken to pieces at will, and just as easily readjusted. **A child can operate it.** Simply by pressing the centre rod the current of electricity is generated, and the light is instantaneous.

ECONOMY.—The material to charge the Battery can be obtained at any drug store at a cost of Ten Cents, and will run 30 to 60 days. Any part can be replaced at a cost not exceeding Ten Cents. Aside from its use as a lighter this apparatus does away with the use of matches and the dangerous results and disagreeable odors arising from same. We have taken especial care in the manufacture of these Electric Lightning Batteries. They are handsomely constructed in nickel plate and highly ornamental, and will take a prominent place among the bric-a-brac of reception rooms, parlors etc. Full directions accompany each apparatus. Aside from lightning purposes, the battery of our apparatus can be used for Motor Fan, Medical, Call Bell or Burglar Alarm purposes, all of which attachments we supply. Goods shipped C. O. D. on receipt of Twenty per cent.

LIBERAL DISCOUNTS TO TRADE AND AGENTS.

We desire reliable representatives in every State in the Union, and invite correspondence on the subject.

For Sale for Cash, or Credit on Car Trust.

20 Second-Hand Standard Passenger Coaches.
30 New Standard Gauge Passenger Coaches, built at one of the best works in the United States. All modern improvements. Price, $3,700 each. Now ready to letter.
40 Second-Hand Narrow Gauge Locomotives, different sizes.
Second-Hand Standard Gauge Locomotives, different sizes.
Second-Hand Box Cars, 20 tons capacity; liberal terms.
These Locomotives have been overhauled, all in good condition, ready for immediate delivery.

1,000 tons of 40-lb. second-hand steel and iron rails.
800 tons of 35-lb iron and steel rails, second-hand.
1,200 tons of 40-lb. iron and steel rails. All these rails are in good order.
Also 9 Sleeping Cars suitable for theatrical purposes, second-hand. 70 Box Cars and 70 Coal Cars, 20 tons capacity each, second-hand.
Southern and Western Delivery.

Agent for Wm. B Pollock & Co.'s Oil Tank Cars, for sale at lowest possible prices. Photos and specifications sent with prices if desired. Bonds negotiated on new and old roads Long roads preferred.

Apply to ALFRED W. LADD,

44 Broadway, NEW YORK.

Estimates furnished for Electrical Equipment under Latest Improvements.

AGENTS: { J. H. FALL & CO., Nashville Tenn.
THOS. P. ALSTON, Esq., 62 East Alabama St., Atlanta, Ga.
G. D. BUSTEMANTE, Birmingham, Ala.

—THE—

Birmingham & Jones Valley R.R. Company,

OF BIRMINGHAM, ALABAMA,

Offers for sale at 85 per cent. one Million of their first mortgage 6 per cent Bonds, which is only $15,000 per mile, making it a safe, paying investment.

For information call on or address,

ALFRED W. LADD, Sole Agent,

44 Broadway, NEW YORK.

TRAVELERS' REGISTER.

Standard Time.
Erie Railway.
Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.
(Standard Gauge.)

Depart for—
Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—
Zanesville and Coshocton—10:30 a. m.,6:30 p m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.

Trains marked * run daily.

Valley Railway.
FOR AKRON, CANTON AND MARIETTA.
Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Chicago Express	*8 35 a m	*10 00 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 20 a m

*Daily. †Daily, except Sunday.

I. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	d5 25 a m	7 45 a m
	d11 40 a m	d1 40 p m
	6 35 p m	d11 10 p m
Wellsville, Wheeling and Bellaire.	12 30 p m	7 45 a m
	6 35 p m	1 05 p m
	.....	*11 10 p m
Alliance Accom.....	10 10 a m	3 25 p m
Ravenna Accom.....	8 25 a m	5 00 p m

d Daily. *Except Saturday. Other trains except Sunday. Through Pullman Sleepers to New York on 1:40 p. m. train daily.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	d 7 00 a m	d 8 00 a m
	d 5 40 p m	d 8 00 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	12 30 p m	1 05 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	d 5 40 p m	d 8 00 a m
	10 10 a m	3 25 p m

d Daily. Other trains except Sunday.
Pullman Palace Sleeping Cars daily between Cleveland, Columbus and Cincinnati City ticket office, Weddell House corner.

—THE—

Cleveland & Marietta Ry.

THROUGH TRAINS

BETWEEN

Toledo, Cleveland and the Ohio River.

The shortest and best Route via Marietta to

Washington, D. C., Charleston, W. Va., Parkersburg, W. Va., and the South.

Direct connections at Union Depots, with all great through lines to all Points

WEST, NORTHWEST, SOUTH, SOUTHWEST AND SOUTHEAST.

Lowest Rates. Quickest Time.

Best Accommodations.

Tickets sold and baggage checked through to destination. Reliable information and best rates will be furnished by any agent of the Popular C. M.

A. T. WIKOFF, Pres. and Gen. Mgr. W. K. RICHARDS, G. P. & T. A.

ERIE RAILWAY

THE FAVORITE
—AND—
PICTURESQUE ROUTE
—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the South east.

New Central Depot So. Water St. and Viaduct

	Depart.
No. 62, Accommodation.....	† 6 00 a m
No. 72, New York & Pitts. Express.....	* 8 15 a m
No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 3 00 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 71, N. Y. & Pittsburgh Express...	* 7 00 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 20 p m
No. 73, Leavittsburgh Local.....	2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No. 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.

A. M. TUCKER, Gen. Mang., Cleveland, O.
W. C. RINEARSON, Gen. Pass. Ag't, New York.
G. E. FOUTS, C P. & T. A., Cleveland.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland, Pittsburgh, Washington, Baltimore and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

"For scenery picturesque and varied,
Through valleys green, 'mong mountains ser-[ried,
The people's favorite route I ween,
The P. & L. E. sits enthroned as queen."

See that your tickets read via

THE PEOPLE'S FAVORITE ROUTE

E. HOLBROOK, Gen'l Supt., A. E. CLARK, G. P. & T. A. Pittsburgh, Pa.

FT. WAYNE, CINCINNATI & LOUISVILLE RAILROAD.

The Popular Route Between the

NORTH and SOUTH

The Direct Route to or from

Fort Wayne, Indianapolis, Terre Haute, Evansville and St. Louis.

13 MILES SHORTER BETWEEN 13

Fort Wayne and Indianapolis,

Than any other Route.

22 MILES SHORTER AND QUICKER 22

BY THREE HOURS, BETWEEN

Louisville and Fort Wayne.

ASK FOR TICKETS VIA

Ft. Wayne, Cincinnati & Louisville R. R.

For sale by all Agents of connecting lines, East, West, North and South.

GEO. W. SAUL, Gen'l Supt. W. H. FISHER, Gen'l Pass. & Tk. Agt.

FORT WAYNE, IND.

SCIOTO VALLEY RAILWAY.

Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

Shortest and Quickest Route to Richmond, Lynchburg, Newport News, Old Point Comfort.

J. ROBINSON, Receiver, Columbus, O. JNO. J. ARCHER, Gen'l Pass. Agt

THE HAZELTON TRIPOD BOILER

Furnishes more and dryer steam with less fuel, and generates steam more rapidly, than any other boiler in use.

CLEVELAND REFERENCES.

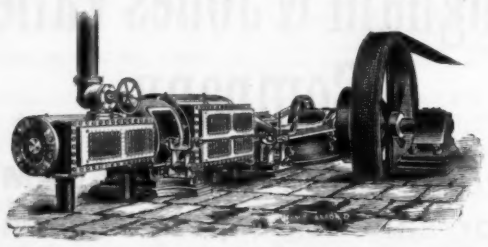
J. W. Britton, Esq..
Woods, Jenks & Co.,
W. S. Tyler Wire Works Co.,
Cleveland Forge & Iron Co.,
Bishop & Babcock Co.,
Cleveland Saw Mill & Lumber Co.
Cherry Valley Iron Works, Leetonia, O.,
Federal St. & Pleasant Valley Pass. Ry., Pittsburgh, Pa.,
Anglo-American Provision Co., Chicago,
Wellsville Plate & Sheet Iron Co., Wellsville, O.,
Falcon Iron & Nail Co., Niles, O.

Address: THE HAZELTON TRIPOD BOILER CO.,

GEO. A. HUMPHREYS, Ag't, 723 Perry-Payne Bldg., CLEVELAND, O. 809 Monon Block, 324 Dearborn St., CHICAGO, ILL.

Who also offer the Hazelton Purifier which we guarantee will remove 90 to 95 per cent. of the impurities from feed-water.

WILLIAM TOD & CO., YOUNGSTOWN, OHIO.



The Porter Hamilton Engine.

Single Compound and Condensing-100 horse-power and upwards.

THE HAMILTON BLOWING ENGINE, HYDRAULIC CRANES, ACCCUMULATORS AND SHEARS.

HEAVY SPECIAL MACHINERY GENERALLY.

☞ SEND FOR ILLUSTRATED CATALOGUE.

THE DEMING CO.,

SALEM, OHIO.

Pumps,

For HAND AND POWER.

Adapted for BOILER FEEDING, FIRE PURPOSES, etc.; also ARTESIAN WELL CYLINDERS and WORKING HEADS for FACTORIES, MILLS and FURNACES.

HENION & HUBBELL, 55 & 57 N. Clinton St., Chicago, General Western Agents

Send for illustrated catalogue and price list. Mention this paper.

BOILERS

MAHONING BOILER WORKS.

PIPES, STACKS, BEAMS, ROOF TRUSSES, BLAST FURNACES, ROLLING MILL WORK.

WM. B. POLLOCK & CO. YOUNGSTOWN, O.

E. H. JONES & CO.,

ENGINEERS AND CONTRACTORS,

223-225 River St., CLEVELAND, O.

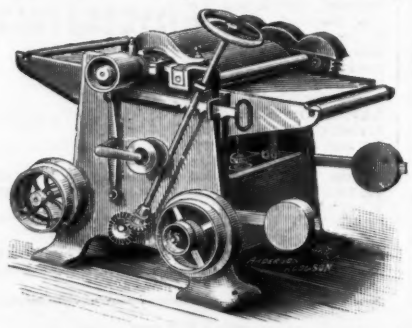
Steam Plants Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWERS, COILS, ETC.,
FOR HOT BLAST HEATING.

FRANK & CO., BUFFALO, N. Y.

MANUFACTURERS OF

Band Saws, Scroll Saws, Universal Saw Benches,



Saw Mandrels, Pony Planers,
Matchers, Friezing Machines,
Shafting, Pulleys, Hangers,
Couplings, Wood Turning and
Pattern Makers' Lathes.

WOOD WORKING MACHINERY.

THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

PRESSES, DROP PRESSES, DIES,

AND

Special Machinery

DESIGNED AND BUILT TO ORDER.

Dies for all kinds of sheet metal goods, leather, paper, etc. Inventors' models and specialties. Send for circulars and prices.

St. Clair and Washington Streets.

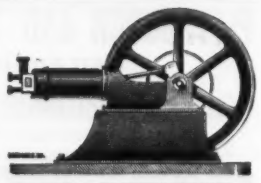
Mention this paper. TOLEDO, O.

Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., { Philadelphia. Chicago.

Horizontal **OTTO** Gas Engines.
Vertical **OTTO** Gas Engines.
Twin Cylinder **OTTO** Gas Engines.
Combined **OTTO** Gas Engine Pumps.
Combined **OTTO** Gas Engine Dynamos.

SIZES: 1, 2, 4, 7, 10, 15, 25 AND 50 HORSE-POWER.



HERCULES POWDER

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE

Known to the Arts.

POWDER, FUSE, CAPS,

Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

Rapid Harness Menders.

Strong and simple. Easily applied. A common hammer does the work. Just drive them in and clinch them.

Sell like hot cakes. They are packedi n neat counter cases and can be displayed to great advantage. This is not an article for the harness trade, but for hardware merchants. Samples, circulars andfull particulars mailed on application.

BUFFALO SPECIALTY MFG. CO., Buffalo, N. Y., U. S. A.

ENGRAVINGS
OF MACHINERY
And Manufactured Articles
OF EVERY DESCRIPTION

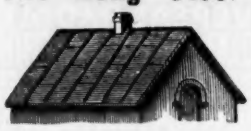
SEND PHOTO OR DRAWING FOR ESTIMATE

UNION PHOTO-ENG CO.

215 WATER ST. CLEVELAND, OHIO.

The Long Steel & Iron Roofing & Corrugating Co.,

(Successors to O. S. KEELY & CO.) Manufacturers of



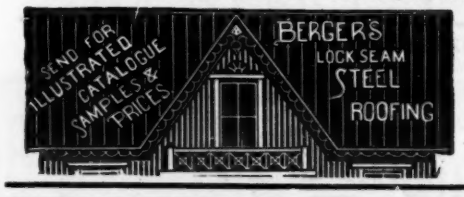
STEEL AND IRON ROOFING,

Corrugated Siding and Ceiling, Iron Ore Paint, Cement, Etc.

N. E. Cor. Illinois and Merrill Streets, INDIANAPOLIS, IND

Write for Catalogue and Price List.

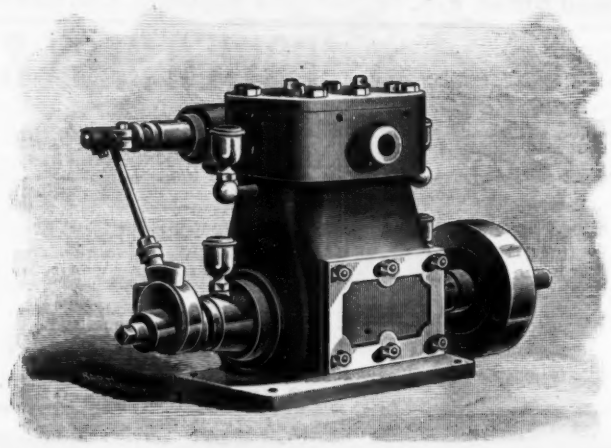
The BERGER MANUFACTURING COMPANY, CANTON, O.



DON'T make arrangements for ROOFING until you have seen ours.

It Excels all other Metal Roofs.

WESTINGHOUSE ENGINES



THE ORIGINAL WESTINGHOUSE ENGINE,

BUILT A. D. 1880.

SIZE 3x3. 1,000 REVOLUTIONS.

Now preserved in the Offices of the Company, Pittsburgh, Pa.

THE WESTINGHOUSE MACHINE COMPANY.

PITTSBURGH, PENNA. U.S. OF A.

SKINNER ENGINE CO., ERIE, PA.

OVER 4500 IN USE.

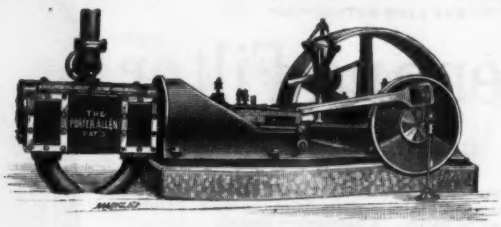
MANUFACTURERS OF

AUTOMATIC, STATIONARY & PORTABLE

ENGINES and BOILERS

SEND FOR CATALOGUE.

SOUTHWARK FOUNDRY & MACHINE CO., Philadelphia, Pa.



SOLE MAKERS OF THE

PORTER-ALLEN AUTOMATIC ENGINE.

ALSO BUILDERS OF

Blowing Engines, Reversing Engines, Hydraulic Cranes,
Centrifugal Pumps, Accumulators, Boilers Tanks, etc.

GARRY IRON & STEEL ROOFING COMPANY

CORRUGATED

ROOFING SIDING & CEILING

CLEVELAND OHIO.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

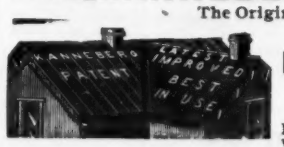
IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS

THE KANNEBERG ROOFING CO., Canton, O.

The Originators of Strictly Genuine Steel Roofing.)



MANUFACTURERS OF THE

Kanneberg Pat., Latest Improved, Folded Lock Seam Roofing,

Made of STRICTLY GENUINE STEEL.

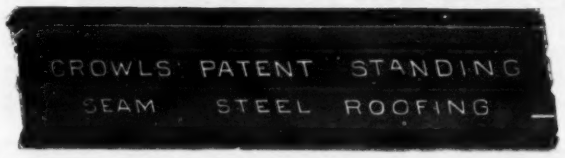
CORRUGATED IRON (four sizes of corrugations), and Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Dry and Ready Mixed Paints, Etc

Write for Catalogues, Price Lists and Samples.

FOR SALE---BLOWING ENGINE.

Vertical pattern, with balanced steam slide valve gear, steam cylinder 14-in. diameter, air cylinder 40 in. diameter, stroke 24 in., 1 to 190 strokes per minute; engine new. For price and particulars address THE JAMES LEFFEL & CO., Springfield, O.

CAMBRIDGE ROOFING CO., Cambridge, O. & Chatanooga, Tenn.



Manufacturers of

Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling.

PURE STEEL A SPECIALTY

Send for Descriptive Catalogue.

WHAT'S THAT?

For good quality and bottom prices order your FACINGS, FIRE-BRICK, CLAY,

FOUNDRY SUPPLIES,

MOULDING SAND and everything for a foundry, of

That's What!

F. B. STEVENS,

DETROIT, MICH.

CRIMPED

SYKES' IMPROVED

Best Roof in the World. Suitable for all classes of buildings. Easy put on.

All my Iron and Steel is re-rolled and box annealed, well painted on both sides with the Best of Paint and Pure Linseed Oil.

CORRUGATED

SYKES IRON & STEEL ROOFING CO.,

Send for Circular and Price List, and mention this paper.

NILES, O., and CHICAGO, ILL.

STILWELL'S

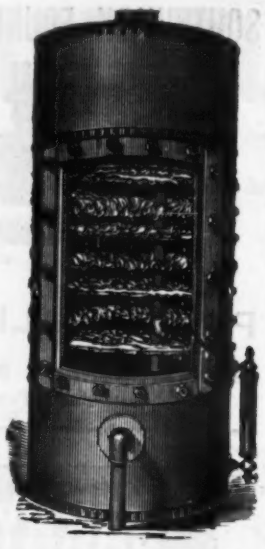
PATENT LIME-EXTRACTING

Heater and Filter

COMBINED,

Is the only lime-extracting Heater that will prevent scale in steam boilers, removing all impurities from the water before it enters the boiler. Thoroughly tested.

OVER 3,000 OF THEM IN DAILY USE.



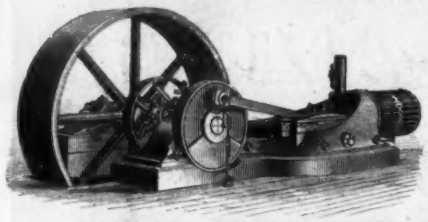
This cut is the fac simile of the appearance of the shelves o. a No. 5 Heater at work on ordinary lime-water when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUES.

Stilwell & Bierce Mfg. Co.,

DAYTON, OHIO.

THE BUCKEYE AUTOMATIC CUT-OFF ENGINES.



Slow Speed, Medium Speed, and High Speed Engines.

Simple Compound, and Triple Expansion Engines, High Pressure Boilers.

Complete Steam Power Plants of Highest Attainable Efficiency.

Address BUCKEYE ENGINE CO., SALEM, O.

SALES AGENTS:

Buckeye Engine Co., Sales Agency, 10 Telephone Building, New York.
A. A. Hunting, John Hancock Building, Boston, Mass. Robinson & Cary Co., St. Paul, Minn.
N. W. Robinson, 97 Washington St., Chicago, Ill.

Water Gas Furnaces

FOR LOCOMOTIVES, STEAMBOATS AND STATIONARY BOILERS.

A Perfect Smoke Burner.

W. S. HUTCHINSON. **6 Washington-st., Chicago.**

OLD 1874. **CLEVELAND TWIST DRILL CO.,** RELIABLE 1891.

SEND FOR CATALOGUE. **Cor. Lake & Kirtland Sts., Cleveland, O.** WRITE FOR DISCOUNTS.

UNIVERSAL RADIAL

RADIAL DRILLING MACHINES
THREE DESIGNS, SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO CINCINNATI O. U.S.A.

The Hart or Detroit

Emery Corundum Wheels and Machinery.

Write to J. WENDELL COLE, M. E.,

District Manager, Box 153, Chicago, Ill., or Box 84, Columbus, O.

N. B.—Also Agent for WM. SELLERS & CO.'S SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

Awarded the GRAND PRIZE at the Paris Exhibition.

Cleveland Office, 412, Perry-Payne Building, Cleveland, O.

Penberthy Automatic Injector.

OPINIONS OF THE PENBERTHY INJECTOR.

RUGG FULLER & CO.,
PLUMBERS, STEAM AND GAS FITTERS.
MINNEAPOLIS, MINN., May 27, 1891.

Penberthy Injector Co., Detroit, Mich.

GENTLEMEN:—It gives us much pleasure to state that the Penberthy Injector gives our trade *better satisfaction than any Injector we ever handled before.*

Yours very truly,
RUGG, FULLER & CO.

PENBERTHY INJECTOR CO., Manufacturers, Detroit, Mich.

Jobbers of all Kinds of **Roofing Materials.**

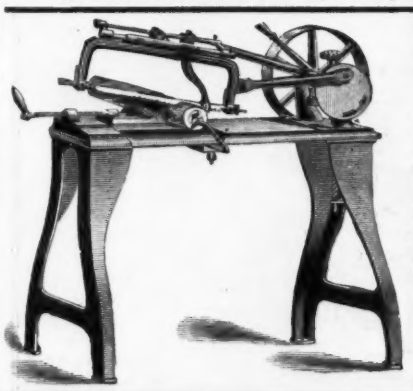
WM. EBERTS. ESTABLISHED 1871 J.M. EBERTS

EBERTS BROS.,

MANUFACTURERS OF
CORRUGATED IRON ROOFING, SIDING & CEILING.
OFFICE AND WORKS 192 TO 198 HIGH ST. WEST
DETROIT, MICH.

PRESSED STANDING SEAM V Crimped and Roll Cap **IRON ROOFING.**

POWER HACK SAW



This Saw, as seen in the cut, is made to run with a belt, and is adapted to our 10, 11 and 12 inch Star Hack Saw Blades. One blade used in this frame will do ten times as much work as is usually done with it by hand, as the speed and pressure are regulated and uniform. It runs forty strokes per minute and does its work without attention. It cuts iron and steel up to 5 inches in diameter. We guarantee the entire satisfaction to all who buy the Saw on our recomendation We are the only headquarters for **Star Hack Saw Blades.**

Price of Power Saw, $25.00.

MILLERS FALLS CO.,

93 Reade St., - NEW YORK.

PRESSED WROUGHT IRON OPEN TURN BUCKLES.

BEST AND Cheapest.

The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

GRAHAM TWIST DRILL CO. Detroit, Mich.,

Sole manufacturers of **GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS and CHUCKS.** Endorsed by progressive mechanics everywhere. Send for Catalogue.

REYNOLDS BROS.,
MANUFACTURERS OF

Hand Cut Files

AND RASPS.

We solicit the commercial trade only.

133 & 135 N. Water St.,
COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list.

INDUSTRY FILE WORKS,
A. & H. Gough, Props.
Manufacturers of

Files and Rasps,

Equal to the Best English File.

OLD FILES RE-CUT.

All Kinds of Job Grinding.

OFFICE & WORKS,
48 COLUMBUS ST.,
CLEVELAND O.
C. GOUGH Manager.
Mention this paper.

Have You Seen the Gisholt Tool Grinder?

With this machine anyone who can read, can keep all the Lathe tools in your shop in perfect order and at a THIRD of the USUAL cost by HAND and in a very superior manner. If you are in the market for such a tool or would like to learn something of it, address your inquiry

THE PARKIN & BOSWORTH CO., 6 South Water Street, CLEVELAND, OHIO.

MANAGER OR SUPERINTENDENT,

For Cast Iron Pipe Foundry advantageously located on line of railroad in a Southern city; excellent shipping facilities to all points. One thoroughly competent and experienced, who is willing to back his ability by investing $10,000 to $15,000 in stock company. Address

C. H. GARDNER,

Care of "Iron Trade Review," CLEVELAND, O.